The Science and Art of Maya Painted Ceramic Vessels

The Science and Art of Maya Painted Ceramic Vessels: Contextualizing a Collection

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Los Angeles County Museum of Art

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Director's Foreword

The Science and Art of Ancient Maya Ceramics: Contextualizing a Collection looks deeply into the making of twenty-five polychrome ceramic vases created by Classic Maya artists more than a millennium ago. Weaving together close observations of these beautiful artworks, scientific analyses of their constituent materials, and Indigenous knowledge of traditional ceramic engineering and artistry, this book allows a glimpse into the minds of Classic Maya artists—their empirical knowledge of the natural world, as well as their technical skill that transformed raw materials into art. It is both a privilege and a responsibility for a museum such as LACMA to not only care for and conserve our collections, but also to investigate them so that we can share their histories with our visitors and communities.

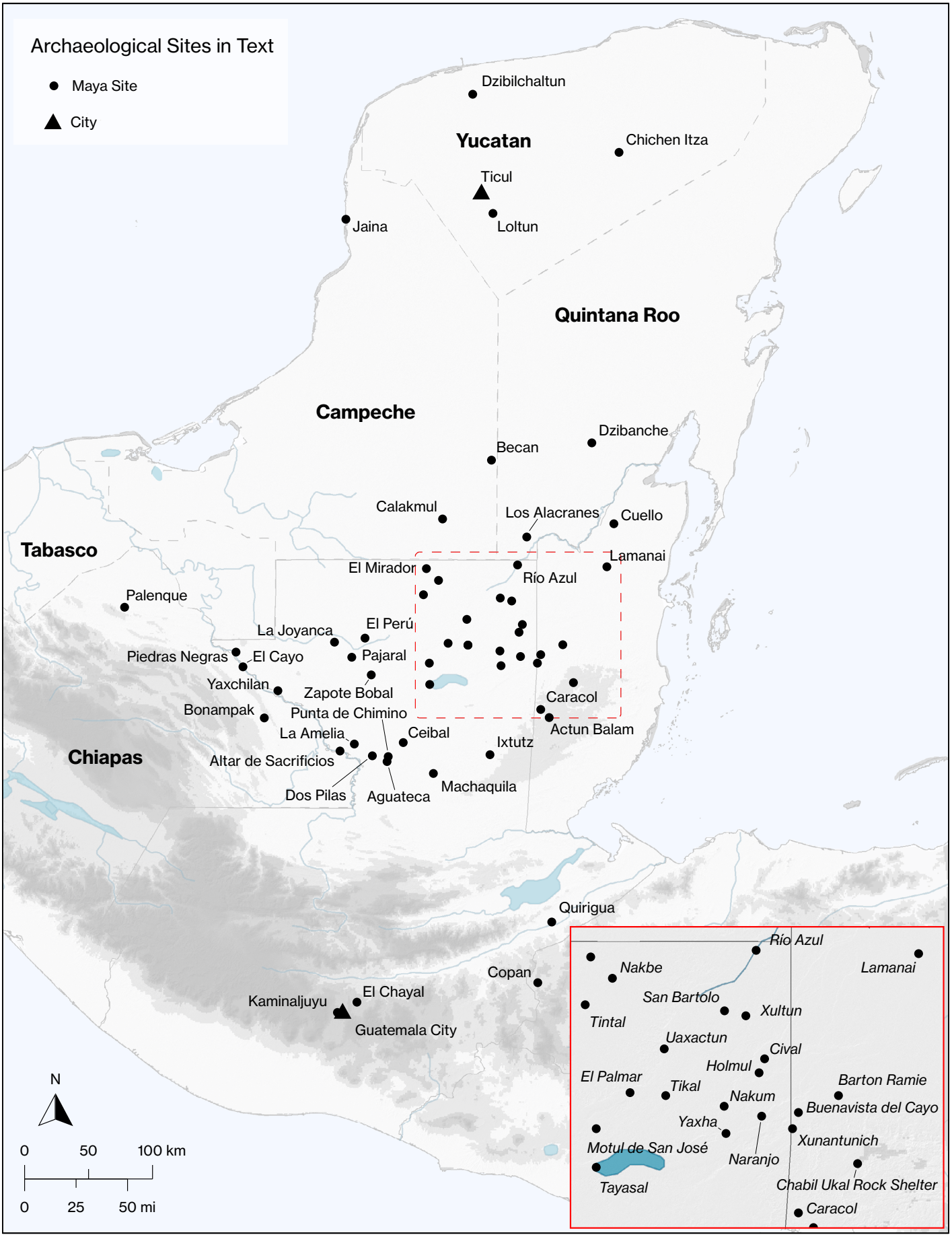
The Science and Art of Ancient Maya Ceramics exemplifies the importance of collaborative work within the museum. Diana Magaloni, who today heads both the Department of Art of the Ancient Americas and the Conservation Center at LACMA, brought together the art historical and anthropological expertise of the curatorial team, the expert knowledge of renowned scholars in the field of Maya art and culture, and the specialized scientific skillset of the conservation team to consider the art and science of these twenty-five vessels.

In accordance with LACMA's mission to foster cultural equity and promote meaningful engagement with the countries of origin for the objects in our care, the museum's Publications Department conceived of *The Science and Art of Ancient Maya Ceramics* as a freely accessible digital publication, available in both English and Spanish. In this manner, the knowledge produced by the diverse and outstanding team of art historians, anthropologists, conservators, conservation scientists, and technical-imaging experts can be easily shared with students of the Classic Maya around the world.

Significant museum publications focused on conservation issues are rare these days, as are publications representing nearly a decade of work, and fewer still in this field of ancient objects and conservation are bilingual seeking an international audience. This publication serves three overlapping and interrelated roles: as a methodological handbook, encouraging other technicians to replicate this study's scientific processes; as a technical catalogue, documenting in depth the findings of this study for each of the vessels under consideration; and as an anthropological and art historical reflection on the cultural, historical, and artistic phenomena that enveloped the creation of these sorts of colorful vessels. It is my sincere hope that scientists, researchers, and students alike make use of this open-access publication to build on these initial efforts and to continue to deepen our understanding of Classic Maya pottery.

Thank you to our Conservation Center, to the Art of the Ancient Americas team, and to our Publications partners for bringing to light such an important work. Finally, I extend my gratitude to Dan Greenberg and Susan Steinhauser, whose vision and support made this publication possible.

Michael Govan
CEO and Wallis Annenberg Director
Los Angeles County Museum of Art


Archaeological Sites in Text
Maya Site
City
Dzibilchaltun
Yucatan
Chichen Itza
Ticul
Jaina
Loltun
Quintana Roo
Campeche
Dzibanche
Becan
Calakmul
Los Alacranes
Cuello
Tabasco
Lamanai
El Mirador
Río Azul
Palenque
La Joyanca
El Perú
Piedras Negras
El Cayo
Pajaral
Yaxchilan
Zapote Bobal
Caracol
Bonampak
Punta de Chimino
Actun Balam
La Amelia
Ceibal
Ixtutz
Chiapas
Altar de Sacrificios
Machaquila
Dos Pilas
Aguateca
Quirigua
Copan
Kaminaljuyu
El Chayal
Guatemala City
N
0
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100 km
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25
50 mi
Río Azul
Nakbe
Lamanai
San Bartolo
Xultun
Tintal
Uaxactun
Cival
Holmul
El Palmar
Tikal
Barton Ramie
Nakum
Buenavista del Cayo
Yaxha
Xunantunich
Motul de San José
Naranjo
Tayasal
Chabil Ukal Rock Shelter
Caracol

1 Introduction

Diana Magaloni

The Department of Art of the Ancient Americas, the Conservation Center, and the Publications Department at the Los Angeles County Museum of Art (LACMA) collaborated to conceive and produce this bilingual online publication, which presents extensive research on twenty-five Maya painted ceramic vessels from the museum's collection undertaken as part of the Maya Vase Research Project, started in 2015. Conducted by a team of curators, conservators, a conservation scientist, a conservation photographer, and invited scholars, this interdisciplinary project examined the materials and artistic processes involved in the creation of these beautiful vases. A methodological approach centered around controlled microarchaeological investigation allowed each of these museum objects to reveal the kinds of knowledge and human skills involved in its conception and manufacturing, recovering cultural and social contexts that were lost in all of their modern histories through uncontrolled digging and the pressures of the international art market.

Reflecting the vision, expertise, and commitment that motivates LACMA's research and programming, the team undertook this project as a form of active engagement with the ethical principles that guide the museum's vision of cultural responsibility. The privilege of stewardship of these Maya painted ceramics requires that their artistic, cultural, and historic value and the worldviews they proudly represent be studied, documented, and disseminated in the broadest and most inclusive manner possible. Accordingly, this electronic bilingual edition can and should be freely shared.

Two important publications on painted ceramic vessels of the Maya Classic period (250–900 CE) that address artistic techniques, procedures, and identities have guided this project. Dorie Reents-Budet's seminal *Painting the Maya Universe: Royal Ceramics of the Classic Period* (1994) served as the catalogue for an exhibition that counted LACMA among its five venues. The outstanding catalogue of the Princeton University Art Museum, *Dancing into Dreams: Maya Vase Painting of the Ik' Kingdom* (2012), coordinated by Bryan Just, includes a specialized contribution on conservation, original ceramic techniques, and material analysis. The current project profited from the ideas and findings produced by these two excellent publications, applying a rigorous methodology and technological advancements to deepen and expand knowledge of key aspects of the art of making painted ceramics.

Examining works from LACMA's permanent collection in a museum context afforded uniform access to each object and fostered a cohesive, interdisciplinary focus. Curator Megan E. O'Neil played a key role in the selection of the Maya painted ceramics included in the study, taking into consideration archaeological, art historical, and epigraphic aspects of each object. Yosi Pozeilov generated invaluable high-resolution technical images using a wide range of photographic and imaging processes (x-radiography, near-infrared false-color imaging, and visible light, reflected near-infrared, induced ultraviolet fluorescence, and rollout photography). Pairing these technologies with the non- and micro-destructive analytical examinations conducted by Charlotte Eng and Laura Maccarelli made possible a thorough characterization of the materials and techniques used to create the vessels. The analytical results could be intimately related to a series of technical images, which in turn were transformed into rich documents for interpretation and comparison. Each object was studied by itself and in relation to the group to better define singular and shared characteristics. The high-resolution images allowed for detailed and exhaustive observation, and comparison of the data obtained through different technical imaging of a single object provided an improved understanding of the artistic procedures and

their relation to the materials used. Lastly, the project combined two specialized points of view in its collective analysis and interpretation of the technical documents created: the in-depth knowledge of the art of ceramic making of the conservator and ceramicist John Hirx, and the extensive knowledge of Mesoamerican artistic materials and procedures that Diana Magaloni, LACMA's Deputy Director, Program Director, and Dr. Virginia Fields Curator of the Art of the Ancient Americas, has accumulated through three decades of studying ancient mural and manuscript paintings. The stimulating team conversations resulted in a series of findings and hypotheses that deepen art historical knowledge of the most salient contributions of Maya ceramic artists to the world:

1 The formulation of the clay body used by the Maya includes both granular and powdered temper composed of marl (*sah kab* in Mayan) and special clays (*sak lu'um*) (the mineral clay palygorskite), which are characteristic of the geology of the Yucatan Peninsula. The reconstruction of this formula made it possible to use the x-radiographs of the vases and x-ray fluorescence spectroscopy of the elemental composition of each clay body as tools to characterize and group the different recipes used to make LACMA's vessels, revealing a new understanding of workshop practices. This reconstruction owes considerable debt to the information provided by the amazing ethnographic work of Dean E. Arnold in Ticul, Yucatan, with present-day Maya potters.

2 The construction by coiling of most wares was a millenary Maya practice developed to technical perfection.

3 The Maya designed and formulated amazingly versatile, thin, and vivid ceramic paints or engobes—mixtures of clays, finely ground minerals, and alkaline fluxes—which could be formulated to achieve distinct optical characteristics, such as glossy and translucent or matte and saturated, depending on aesthetic preferences.

4 Maya potters likely would have needed transient, well-controlled firing environments that allowed for the production of high-quality polychrome wares, similar to the portable kilns used by the potters in Ticul observed by Arnold.

If the hypotheses about ancient Maya ceramic practices and knowledge presented here are true, deep links between present-day Maya potters' Indigenous knowledge and that of their ancestors emerge. For the Department of Art of the Ancient Americas at LACMA, understanding ancient Maya ceramics in the museum's collection through attention to the relevance of Indigenous potters' knowledge and practices constitutes an important methodological guidepost in the institution's scientific pursuits.

The book is divided into three interrelated sections:

The first chapters focus on reconstructing manufacturing techniques: building the ceramic ware, ceramic or engobe painting, and postfire or stucco painting, with a specialized section on composing the clay body and firing.

The second section includes a methodological chapter that explains the technical imaging processes and analytical procedures of the project, serving as a

primer for the use of the resulting images and findings in the following catalogue entries. The catalogue presents art historical and technical analysis for each of the twenty-five vessels alongside relevant technical images. This section is designed as a methodological tool for art historians, conservators, and archaeologists. Its structure, as well as its availability in Spanish, is intended to promote similar efforts in other institutions, including Guatemalan and Mexican museums.

The third section provides further context and another approach to the collection through contributions by recognized specialists in the fields of Maya archaeology and art history. The scholars whose work appears here have helped define current understandings of Maya culture and art: Dorie Reents-Budet and Ronald L. Bishop, studying the results obtained by instrumental neutron activation analysis of Classic Maya ceramics, present a series of possible groupings in which some LACMA vessels can be included. Héctor Leonel Escobedo Ayala gives an overview of the cultural development of Maya cities and the role of painted ceramics during each period. Megan E. O'Neil reflects on the possible links between the Maya worldview and different aspects of the process of building, painting, and coloring ceramic vessels. Oswaldo Chinchilla Mazariegos presents an in-depth iconographic study of LACMA's Lunar Gods Vase (cat.7). Mary E. Miller explores a characteristic Mesoamerican practice, the production of almost identical objects for ritual use, addressing the details of workshop practices through examples of vessels in LACMA's collection. Stephen Houston examines the social contexts behind the production, use, and exchange of these precious objects in ancient times. Together, these distinct perspectives help to illuminate the ways in which LACMA's collection of Maya painted vessels reveals the complexities of Maya society and culture.

2 Studies in the Art and Science of Ancient Maya Painted Ceramics and LACMA's Maya Vase Research Project

Megan E. O'Neil

Painted ceramic vessels constitute one of the most important artistic media for the Maya of the Classic period (250–900 CE) from myriad sites in the southern Maya lowlands, which encompass parts of Mexico, Guatemala, Belize, and Honduras. These objects of prestige played an integral part in the education of young Maya elites in historical and mythical narratives and served as objects of exchange, whether by powerful individuals in special ceremonies, in the context of Maya courtly life, or in acts of relationship building among often competing rulers who established themselves as divine queens and kings.[1] The vessels also carried their prestige to the otherworld, accompanying the deceased as mortuary offerings in tombs.

The LACMA collection of painted ceramic vessels ranks among the most important in the United States for the breadth and quality of the artworks. It is also the most comprehensive repository of Maya sacred visual narratives outside Mesoamerica. Maya painted vessels describe a universe in which animals, plants, humans, and supernatural beings participate in a continuous cosmic process of transformation. Today, these extraordinary vessels provide a link between the ancient Maya artists who created them and contemporary observers, researchers, and museumgoers alike.

LACMA's multidisciplinary Maya Vase Research Project integrates the humanities and materials sciences and seeks comparisons with archaeologically excavated vessels. This research project follows the LACMA Conservation Center's Steps for Technical Study, a protocol that requires clear intent and understanding of the question of study, intense observation of the object, consideration of the conservation and safety of the object, technical photography, scientific analysis, and discussion and redirection (if needed). According to the conservator and ceramicist John W. Hirx, "As potters are working, they often obliterate what they have done. One has to be careful about how one interprets the trail."[2] The project's approach thus takes shape as both a collaborative and iterative process in which researchers repeatedly return to direct analysis of the objects in comparison with digital imagery and other analytic tools.

To begin the project in 2015, participants chose fifteen Maya vessels spanning broad chronological and geographic ranges and diverse ceramic techniques. The intent of this wide selection of objects was to explore the possibilities of where this type of research could lead and to identify in which directions the application of this methodology might best expand knowledge in the field of Maya ceramics. LACMA held two Maya-vase workshops with participating outside scholars in 2015 and 2016, and part of the project's research appeared in the LACMA exhibition *Revealing Creation: The Science and Art of Ancient Maya Ceramics* (May 21, 2016–June 4, 2017), curated by Megan E. O'Neil. Based on internal discussions and consultation with outside collaborators, the project added another set of vessels to the study sample to allow for comparative analysis of objects from the same regions or in the same styles. As the project has progressed, researchers have focused on ceramic manufacturing and decoration techniques as well as modifications after creation. Many of the techniques employed by the project have been used in conservation science for years, but their specific application to Maya ceramics and multidisciplinary collaboration with experts in multiple fields make this endeavor unique. Scholars and scientists working on the Maya Vase Research Project strive together not only to identify materials and manufacture but also to seek meaning in those materials and techniques.

Polychrome ceramics comprise a distinctive Classic Maya art form made in diverse temporal and regional styles across the southern Maya lowlands. Even for unprovenienced ceramics that came through the art market and not from archaeological excavations, researchers can frequently identify region of origin by studying the

1 For a discussion of Maya ceramics in relation to gifting and the social lives of young elite men, see Stephen Houston, *The Gifted Passage: Young Men in Classic Maya Art and Text* (New Haven, CT: Yale University Press, 2018).

2 John W. Hirx, personal communication, 2015.

vessel shape, painting style, or textual references to persons or polities. For example, lidded basal-flange cache vessels in the form of animals are characteristic of third- to sixth-century ceramics from the northern Peten, in Guatemala, and southern Campeche, in Mexico. Tripod cylinder vessels, often with lids, were made in the Maya region during the fourth through sixth centuries, following extensive contact with Teotihuacan, in present-day Mexico (see, for instance, cats. 12–14).

Maya artists from the seventh to ninth centuries created taller cylinder vessels, usually without feet or lids, and painted or carved complex pictorial narratives around their exteriors. Distinctive vessels from the Holmul-Naranjo region in northeastern Guatemala and northwestern Belize characteristically display a red and orange palette and scenes of the dancing Maize God (see, for instance, cats. 21 and 24). The intricate pictorial narratives of Ik'-kingdom vessels, from in or near Motul de San José, Guatemala, are illustrated in multiple colors and made in several sub-styles, including the Pink Glyphs style.[3] Codex-style vessels, painted with cream or white backgrounds, black and brown lines for images and texts, and red borders, come from the northern Peten and southern Campeche (see, for instance, cats. 1–5).[4] These prized, portable items were shared within and across polities. The vessels in this study provide a rich source for understanding ancient Maya mythology but must be understood in relation to materials excavated from archaeological sites.[5] Nonetheless, certain deficiencies will always limit knowledge of unprovenienced objects. Even if researchers can identify the name of an owner or a site of manufacture, they cannot always reconstruct the full life history of the vessel, perhaps missing whether it was carried or gifted to another person or polity and lacking information about the place or context in which it was deposited.[6]

Ceramics have long been central to Maya archaeology. Sherds, ubiquitous in Maya excavations, form the core of chronological frameworks, and archaeologists and ceramics scholars have researched Maya pottery and techniques for decades. Classic publications such as Robert E. Smith's *Ceramic Sequence at Uaxactun, Guatemala* (1955) and Anna O. Shepard's *Ceramics for the Archaeologist* (1956) set the stage for technical analyses that studied ancient materials, experimented with reproducing ceramics, and looked to the ethnographic record for comparanda and inspiration.[7] Shepard, a pioneer in her day, used tools such as x-ray fluorescence, x-ray diffraction, and petrographic analysis, among others, in concert

3
Dorie Reents-Budet, *Painting the Maya Universe: Royal Ceramics of the Classic Period*, exh. cat. (Durham, NC: Duke University Press in association with Duke University Museum of Art, 1994); Mary E. Miller and Megan E. O'Neil, *Maya Art and Architecture*, 2nd ed. (London: Thames & Hudson, 2014); Bryan Just, *Dancing into Dreams: Maya Vase Painting of the Ik' Kingdom*, exh. cat. (Princeton, NJ: Princeton University Art Museum; New Haven, CT: Yale University Press, 2012); Christina T. Halperin and Antonia E. Foias, "Pottery Politics: Late Classic Maya Palace Production at Motul de San José, Petén, Guatemala," *Journal of Anthropological Archaeology* 29, no. 3 (September 2010): 392–411.

4
See Richard D. Hansen, Ronald L. Bishop, and Federico Fahsen, "Notes on Maya Codex-Style Ceramics from Nakbe, Petén, Guatemala," *Ancient Mesoamerica* 2, no. 2 (Fall 1991): 225–43; Sylviane Boucher and Yoly Palomo, "Discriminación visual como determinante de estilo y asignación tipológica de la cerámica códice de Calakmul, Campeche," *Estudios de Cultura Maya* 39 (January 2012): 99–132.

5
For an example of archaeologically excavated ceramics similar to those in this study set, see Boucher and Palomo, "Discriminación visual como determinante de estilo y asignación tipológica de la cerámica códice de Calakmul, Campeche."

6
For a clear demonstration of the value of studying places of origin and deposition of ceramic vessels, see the analyses of the Holmul-style vessel found at Buenavista del Cayo, Belize, in Jennifer T. Taschek and Joseph W. Ball, "Lord Smoke-Squirrel's Cacao Cup: The Archaeological Context and Socio-Historical Significance of the Buenavista 'Jauncy Vase,'" in *The Maya Vase Book: A Corpus of Rollout Photographs of Maya Vases*, vol. 3, eds. Barbara Kerr and Justin Kerr (New York: Kerr Associates, 1992), 490–97.

7
Robert E. Smith, *Ceramic Sequence at Uaxactun, Guatemala*, 2 vols. (New Orleans: Middle American Research Institute, Tulane University, 1955); Anna O. Shepard, *Ceramics for the Archaeologist* (Washington, D.C.: Carnegie Institution of Washington, 1956).

Fig. 1
The potter Lucas Pech making water-storage vessels, Ticul, Mexico, 1965 (photograph by Dean E. Arnold). Source: Dean E. Arnold, *The Evolution of Ceramic Production Organization in a Maya Community*, University Press of Colorado, Boulder, 2015, Figure 4.4.

with careful attention to contemporary Indigenous potters' practices. Hers is a tome still of great relevance.

The field of ethnoarchaeology plays an extremely important role in ceramics studies. For the Maya area, the master of such study is Dean E. Arnold, who has worked for more than fifty years with Maya potters in Ticul, in the Mexican state of Yucatan, studying modern ceramic practice and relating it to ancient production in what he calls "ceramic ethnoarchaeology" (fig. 1). He has sought to gather and better understand Indigenous knowledge by focusing on "engagement theory," particularly regarding the relationship of potters to the natural world, their materials, and their craft.[8] Reading Arnold's work is both enlightening and humbling; most researchers' depth of knowledge about ancient ceramics will never match what he has gained through his close work with contemporary Maya potters.

The Maya Ceramics Project ranks as another essential endeavor in Maya archaeological ceramics involving collaborations of humanities and sciences. Overseen by Ronald L. Bishop and Dorie Reents-Budet, the project studies clay chemistry in order to seek more information about possible origins of vessels.[9] For this research, they obtain paste samples of Maya ceramics and perform neutron activation analysis (NAA) on them, originally in a nuclear reactor at Brookhaven National Laboratory, Upton, New York. They relate these data to epigraphic and stylistic analysis in order to study production and distribution of Maya polychrome ceramics. Their large database, compiled over the course of more than four decades, includes samples of archaeologically excavated materials and items without archaeological contexts in museums and private collections.[10] Before the vessels in this book's study set entered LACMA's collection, Bishop and Reents-Budet sampled them to seek insight into their possible origins, removing material from discrete locations—for instance, from the bottom of a tripod vessel with a palace scene (fig. 2; cat. 17). Their extensive research is fundamental to this current collaborative project.

8
Dean E. Arnold, *Maya Potters' Indigenous Knowledge: Cognition, Engagement, and Practice* (Boulder, CO: University Press of Colorado, 2018), xix, xxi, 8.

9
Ronald L. Bishop, "Pre-Columbian Pottery: Research in the Maya Region," in *Archaeometry of Pre-Columbian Sites and Artifacts: Proceedings of a Symposium Organized by the UCLA Institute of Archaeology and the Getty Conservation Institute, Los Angeles, California, March 23–27, 1992*, eds. David A. Scott and Pieter Meyers (Los Angeles: Getty Conservation Institute, 1994), 15–65; Dorie Reents-Budet et al., "Codex-Style Ceramics: New Data Concerning Patterns of Production and Distribution" (paper, XXIV Simposio de Investigaciones Arqueológicas en Guatemala, Museo Nacional de Arqueología y Etnología, Guatemala City, July 19, 2010); Reents-Budet and Bishop, "Classic Maya Painted Ceramics: Artisans, Workshops, and Distribution," in *Ancient Maya Art at Dumbarton Oaks*, eds. Joanne Pillsbury et al. (Washington, D.C.: Dumbarton Oaks Research Library and Collection, 2012), 288–99.

10
Bishop, "Pre-Columbian Pottery," 38–39.

Fig. 2
Bottom view of a tripod vessel (cat. 17) showing a drill hole (upper left) from NAA sampling

Other important collaborative projects within museums include the Maya Vase Conservation Project of the University of Pennsylvania Museum of Archaeology and Anthropology, in Philadelphia, a collaboration that studied excavated ceramics in the Penn Museum's collection and included multispectral imaging and residue analysis.[11] More recently, the Princeton University Art Museum, in New Jersey, has undertaken research on Ik'-style ceramics.[12] The work of many archaeologists studying Maya pottery, both fine polychrome ceramics as well as more ubiquitous objects used by a broader population, further enriches the field. LACMA's project builds on the excellent work of its predecessors and colleagues, benefiting greatly from their collective research and hoping to add to this body of knowledge.

This book not only presents works from LACMA's collection in light of the current research but also speaks openly about how such objects in a museum collection need to be treated holistically, taking into account multiple viewpoints and voices. These vessels have been well known for many years as images, which Justin Kerr published in his *Maya Vase Book* (1989–2000) and its attendant database.[13] They have thus served as the subject of extensive epigraphic and iconographic research. But these vessels lack archaeological provenience, requiring scholars to speculate about much of their basic history. Nevertheless, the Maya Vase Research Project demonstrates that, through focused multidisciplinary and collaborative study that brings together the inquiries of art historians, conservation scientists, epigraphers, and archaeologists, researchers can reveal new contexts for, and understandings of, these magnificent vessels. LACMA seeks to add dimension to the previous, image-based analysis of these works, stressing the intensive study of the vessels as material objects.

Prior to 1960, few museum or private collections held Maya polychrome ceramic vessels.[14] Collecting of these materials subsequently increased, largely through networks of looters and antiquities dealers. Interest in Maya ceramics spiked especially in the second half of the twentieth century, particularly after international laws began to limit the removal of stone monuments, leaving portable items such as ceramics more vulnerable.[15] Access to these materials unfortunately increased during the Guatemalan Civil War (1960–96), and the archaeological heritage of Guatemala, especially in the Peten, was severely compromised. Looters dug enormous trenches in pyramids, destroying buildings in search of tombs and the precious artifacts they certainly held.[16] Many ceramics ended up in private collections, which museums later acquired.

The field of Maya archaeological studies wrestles with a distinct debate about the validity of studying looted objects, especially ceramics, because of fear that drawing attention to them will foment more looting and because their meaning is distinctly diminished without knowledge of their archaeological context.[17] Nonetheless, such objects still carry enormous cultural value and can help researchers better understand the ancient Maya and their extraordinary artistic traditions. Indeed, Mary E. Miller has noted that, despite the problematic nature of working with looted vases, studying them has opened new worlds of interpretation regarding ancient Maya mythology, ritual, and courtly life, specifically because their diverse subject matters differ from the scenes portrayed on more public stone monuments.[18] Bringing attention to these extraordinary works of art may be viewed as a responsibility: a way to tell their stories, affirming cultural value that might encourage the prevention of looting, and to honor the ancient artists who made them. Ignoring such works would further obscure the histories of those artists and their descendants living in Mexico and Central America as well as in diaspora, to whom this book is intended as a tribute.

11 Lynn A. Grant, *The Maya Vase Conservation Project* (Philadelphia: University of Pennsylvania Museum of Archaeology and Anthropology, 2006).

12 Just, *Dancing into Dreams*.

13 Justin Kerr, *The Maya Vase Book: A Corpus of Rollout Photographs of Maya Vases*, 6 vols. (New York: Kerr Associates, 1989–2000), and the Maya Vase Database, www.mayavase.com.

14 For a history of the study and collecting of Maya ceramics, see Mary E. Miller, "The History of the Study of Maya Vase Painting," in Kerr, *The Maya Vase Book*, vol. 1 (1989):128–45.

15 Clemency Chase Coggins, "United States Cultural Property Legislation: Observations of a Combatant," *International Journal of Cultural Property* 7, no. 1 (January 1998): 52–68.

16 Juan Antonio Valdés, "Management and Conservation of Guatemala's Cultural Heritage: A Challenge to Keep History Alive," in *Art and Cultural Heritage: Law, Policy, and Practice*, ed. Barbara T. Hoffman (Cambridge: Cambridge University Press, 2006), 94–99.

17 John Dorfman, "Getting Their Hands Dirty? Archaeologists and the Looting Trade," *Lingua Franca* (May/June 1998): 28–36.

18 Miller, "The History of the Study of Maya Vase Painting," 137–38.

3 Methodology

Technical Imaging

Yosi Pozeilov

Every explorer needs a map. Sometimes the map is provided, and other times it is made along the way. In this study of Maya ceramics, technical imaging generated that map. Images created through a broad range of photographic and imaging processes, detailed below, aided in guiding the investigation of the objects.

Visible Reflected Light Photography

Visible reflected light (VIS) photography spans the range from 400 to 700 nanometers in the electromagnetic spectrum. As its name suggests, this is the small section of radiation in the form of light detectable by the human eye. This type of imaging, commonly known simply as photography, was performed in a controlled and repeatable-lighting setup, with the camera perfectly parallel to the surface of the object being imaged. The resulting images seek to represent the object as closely and accurately as possible to its real physical state and color. For this study of Maya painted ceramic vessels, several images were taken to cover the circumference or all the facets of the objects. In the case of square vessels, the object's four sides were imaged; for cylindrical objects, six images were made by rotating the vase approximately sixty degrees in one direction until the entire circumference had been captured. The top and bottom were also imaged; the top was imaged in two ways, first by focusing on the rim, and then by illuminating and focusing on the interior bottom of the vase. Every image contains object-level color and gray-scale targets and a centimeters scale, providing size and color reference across all images and objects.

Reflected Near-Infrared Photography

Reflected near-infrared (NIR) photography expands beyond the visible from 700 to 1,100 nanometers. Since the human eye cannot detect this type of radiation, this photographic technique employs the following equipment to make it visible: infrared-radiation-rich lights (specifically, halogen tungsten lamps) for the illumination of the object, a modified camera made sensitive to infrared radiation, and an opaque visible-light-blocking (infrared-transmitting) filter in front of the camera lenses.[1] Vast improvements in NIR photography have resulted from the integration of live-view technology in digital cameras and the ability to modify the camera by permanently removing the "hot-mirror" filter—which under normal circumstances blocks all unwanted infrared and ultraviolet radiation, allowing only visible light to reach the image sensor to generate a normal-looking image. Removing the aforementioned filter restores the sensor's sensitivity to infrared radiation, which allows for shorter exposure times. Live view, which shows the image on the LCD monitor on the back of the camera as the sensor is seeing it, allows for greater accuracy in focusing. Lastly, photographers can assess image exposures for the desired result immediately after capture.

Rollout Photography

Rollout photography creates a panoramic image in the round of a cylindrical object, as if one were peeling out its design. Justin Kerr, a pioneer in this technique, published early rollouts executed on film for some of the same vases imaged during this study.[2] The specialized equipment used for this type of imaging at LACMA included a 4×5 view camera with perspective-correction capabilities equipped with a large-format scan back, which creates an image from a sequence of individual exposures at each point along a horizontal axis. A 135mm apochromatic lens was used to reduce spherical aberration and color errors by bringing light of various wavelengths into focus on a single plane. The scan back was connected to a motorized turntable that synchronized its rotation with the capture time, all done with a controller managed through a laptop and dedicated software. Captures were recorded as open-source 16-bit Digital Negative (DNG) raw files, which facilitate color management and post processing. With a height of six thousand pixels and a length that varied according to the diameter of the ceramic being imaged, these files tend to be very large, with an average size of five hundred megabytes.

For cylindrical vases with continuous designs depicted around them, the use of rollout photography allows the study and visualization of the full vessel in one image. From an art historical and curatorial perspective, such imaging facilitates the interpretation of the depicted scene as well as the reading of the written glyphs found on the vessel. For the scientist, it also facilitates the mapping and marking of sample areas examined using different instrumentation and scientific analysis so that all results appear in one

image. The scan back used for this project can create VIS images with the addition of an infrared-blocking filter, or NIR images with the addition of an infrared-transmitting filter, thus facilitating the generation of well-registered false-color infrared images that can provide researchers with suggested pigment information to be verified by the scientist via analysis.[3]

Near-Infrared False-Color Imaging

Near-infrared false-color (FCIR) imaging is a visualization technique based on the characteristic response of materials to visible and near-infrared radiation. FCIR images are created by rearranging in Adobe Photoshop the red, green, and blue (RGB) channels from the VIS image and combining the monochromatic channel of the NIR image in order to incorporate them in a single image. The VIS and NIR images need to be registered, or aligned, in order to obtain optimal results; this requires extreme care during the photographic processes.[4] FCIR is a simple way to characterize or differentiate between materials and has been used successfully in the examination of pigments, dyes, and inks.

Ultraviolet-Induced Visible Fluorescence Photography

Ultraviolet-induced visible fluorescence (UVF) photography (400 to 700 nanometers) is a photographic technique that starts by using an ultraviolet (UV) radiation source to provoke excitation of elements in the form of fluorescence in the visible spectrum. Only the visible emission of fluorescence coming from the object is recorded by the imaging sensor of a regular camera. UV fluorescence, among other differentiating luminescence, can identify areas restored through inpainting, adhesive use, varnish application, and organic growth patterns. In most cases, the source of UV radiation comes from a light fixture that emits the desired wavelengths. Mercury-vapor lamps are traditionally used due to their characteristic narrow-band emission on a number of wavelengths, including the target 365-nanometer band in the UVA region of the electromagnetic spectrum. Modern light fixtures use a different kind of light bulb that contains a metal halide filament that includes mercury in order to generate the same transmission peak. More recently, LED lights emitting in this same UV region have been used with similar results. In either case, the use of a filter promoting the transmission of UV radiation that isolates the desired 365-nanometer wavelength while blocking visible light is necessary.

1
Yosi Pozeilov, *Digital Photography for Art Conservation*, 4th ed. (self-pub., lulu.com, 2015), 65–109.

2
Dorie Reents-Budet, *Painting the Maya Universe: Royal Ceramics of the Classic Period*, exh. cat. (Durham, NC: Duke University Press in association with Duke University Art Museum, 1994).

3
Dulce María Aguilar-Téllez et al., "False Color and Infrared Imaging for the Identification of Pigments in Paintings," *MRS Proceedings* 1618 (2014): 3–15.

4
Jeffrey Warda, ed., *The AIC Guide to Digital Photography and Conservation Documentation*, 2nd ed. (Washington, D.C.: American Institute for Conservation of Historical and Artistic Works, 2011), 143–46.

Digital X-Radiography

The realm of enhanced vision provided by x-rays, familiar from the medical world and popular culture's supernatural x-ray vision, allowed researchers to learn more about the physical state and manufacturing traits of the vases examined in this study. X-ray imaging records radiation transmitted or absorbed by an object in the highly energized section of the electromagnetic spectrum encompassed between wavelengths of 0.01 and 10 nanometers. As with most contemporary imaging, x-radiography is produced digitally. At LACMA, images were generated using a direct or digital radiography (DXR) system composed of a flat-panel detector and a fixed 270-kilovolt pulsating radiation source. X-ray imaging enabled researchers to determine the extent of restoration of the vessels by enhancing the visibility of breaks, but most importantly, it allowed for the detection of fissures or crack lines less apparent to the naked eye. These traits, together with the physical distribution of inclusion material and patterns made during the manufacturing process, can provide clues regarding the techniques and procedures under which the vases were originally formed.

Individually, most of the imaging techniques described above hardly rank as groundbreaking or unusual. (Digital rollout photography, a notable exception, requires special equipment and know-how.) The methods through which they were combined, however, amplified their ability to facilitate the close study and analytical work that followed. The power in the amalgamation of these imaging techniques mirrors the collaborative spirit of the multidisciplinary team of professionals engaged in this study of an extraordinary corpus of Maya polychrome ceramics in LACMA's collection.

Scientific Methods of Analysis

Laura Maccarelli and Charlotte Eng

The analytical techniques used to examine Maya polychrome vessels in this book's study set include multiple forms of microscopy and spectroscopy. These can be separated into two groups: noninvasive and micro-invasive or micro-destructive, the latter of which required micro-sampling. Each method has its strengths and limitations. By combining data from multiple techniques, information about colorants, clay and slip composition, and materials used in restorations can be acquired.

Microscopy

Close examination of the images provided by Yosi Pozeilov, LACMA's senior conservation photographer, enabled identification of previously treated areas and those that appear to be undisturbed. After evaluation of these images, the vases were examined under magnification. For low magnification, a stereomicroscope was employed. For higher magnification, a Keyence VHX-2000 digital microscope was used; with this instrument, researchers can look at the surface of the object at a range of magnifications from 20× up to 200×. This magnification range allows for the identification of tool marks and the examination of brushstrokes or fibers, incisions, or microbiological growth over painted areas. The stratigraphy of the pigment layers is revealed in some cases due to paint losses, which expose edges that reveal layering.

Portable X-Ray Fluorescence Spectroscopy

After the completion of imaging and microscopy, researchers performed portable x-ray fluorescence (pXRF) spectroscopy on the vessels, using an Olympus Innov-X Delta handheld analyzer. This nondestructive analytical technique can determine surface and some bulk elemental composition. In the case of these Maya vases, the instrument is well-suited for the identification of typical elements found in ceramics, such as aluminum, silicon, calcium, iron, and copper, among others incorporated in the inorganic compounds used in the body, slips, and postfire-paint surfaces of the vases.[1] The handheld instrument is placed close to the surface of the vessel, and a small beam of x-rays is aimed at the surface. This causes atoms in and near the surface to emit x-rays characteristic of each element. The emitted x-rays are detected and analyzed by the pXRF spectrometer. Based on the energies and number of x-rays, elements present in the surface of the vase can be identified.

Fourier Transform Infrared Spectroscopy

Fourier transform infrared (FT-IR) spectroscopy provides molecular "fingerprints" of materials. The technique relies on the vibrations of the bonds between elements of a molecule. Different molecular bonds absorb specific wavelengths of infrared energy. The spectrum they produce is compared with those in a reference database to identify which compounds are present.[2] For this study, the noninvasive method was performed in diffuse reflectance mode with a Bruker Alpha spectrometer. When sampling was required, micro-samples collected using a scalpel were dispersed onto an aluminized glass slide. Powder particles of interest were then analyzed using a SensIR IlluminatIR mounted onto an upright Olympus microscope in attenuated total reflectance (ATR) mode using a diamond-tipped probe. The spectra obtained were used to identify calcite, malachite, carbon black, and other minerals on the surfaces of the vases.

Fiber Optic Reflectance Spectroscopy

Fiber optic reflectance spectroscopy (FORS) is a noninvasive technique that can aid in the characterization of organic compounds such as chromophores (the part of a molecule responsible for its color). An Ocean Optics S2000 spectrometer calibrated with an Ocean Optics LS-1 light source was used with an optical fiber to collect visible reflectance spectra from the surfaces of the vases. Researchers utilized the data to corroborate the presence of specific colorants suggested by false-color infrared images. In these processed images, some pigmented areas appeared magenta, implying the presence of indigo. The Maya used this blue colorant to create one of the first pigments made by humans, known as Maya blue.[3]

Cross Sections

Because some questions could not be answered by applying solely noninvasive techniques (for instance, those regarding stratigraphy and pigments in underlying paint layers), cross-sectional micro-samples were taken from the surface of the vases. Samples were removed with a small scalpel, embedded in Technovit

2000 LC (an acrylate resin), and cured under a blue light. They were then dry-polished using Micro Mesh (grades 120–12,000), mounted on a glass slide, and viewed using a Nikon Microphot polarized light microscope (PLM) in reflected light. (Objectives of 10×, 20×, and 400× magnification were employed). An attached Leica DMC4500 camera was used to capture digital images.[4] The cross sections were used for the two spectroscopic techniques described below.

Raman Spectroscopy

In cultural-heritage research, Raman spectroscopy is used to study and characterize materials such as amber, dyes, glass, glazed ceramics, ivory, pigments, and polymers. The technique measures the shift in wavelength that occurs when a material scatters monochromatic light, providing information on the vibrational motion of a molecule. Typically, different vibrational bands from those observed using FT-IR are detected, thus Raman is considered a complementary method to FT-IR. For this study, Raman spectroscopy was performed with a Chromex Senturion Raman micro-spectrometer with a 20× objective, using a 785-nanometer laser diode at 1% power (about 0.70 milliwatts). Cross sections and micro-samples of materials removed from selected locations on some vases were used for this technique. Raman results confirmed the presence of organic pigments (for instance, carbon black) and inorganic colorants (such as malachite and vermilion). The latter pigments had been suggested by pXRF data.

Scanning Electron Microscopy with Energy-Dispersive X-Ray Spectroscopy

The cross sections were mounted for scanning electron microscopy with energy-dispersive x-ray spectroscopy (SEM/EDS) on an SEM stub using carbon tape. An FEI Nova NanoSEM 230 in low vacuum mode was used with a GAD backscattered detector. The images obtained from the SEM provide more morphological information on particles' size, shape, and orientation. When the SEM is combined with an EDS detector, elemental maps collected from the cross sections show the distribution of elements for each layer.[5]

1
Jim J. Aimers, Dori J. Farthing, and Aaron N. Shugar, "Handheld XRF Analysis of Maya Ceramics: A Pilot Study Presenting Issues Related to Quantification and Calibration," in *Handheld XRF for Art and Archaeology*, eds. Aaron N. Shugar and Jennifer L. Mass (Leuven, Belgium: Leuven University Press, 2012), 423–48.

2
Michele R. Derrick, Dusan Stulik, and James M. Landry, *Infrared Spectroscopy in Conservation Science* (Los Angeles: Getty Conservation Institute, 1999).

3
M. Piccolo et al., "Fiber Optics Reflectance Spectroscopy: A Non-Destructive Technique for the Analysis of Works of Art," in *Optical Sensors and Microsystems: New Concepts, Materials, Technologies*, eds. Sergio Martelluzci, Arthur N. Chester, and Anna Grazia Mignani (New York: Kluwer Academic, 2000), 259–65; John K. Delaney et al., "Use of Imaging Spectroscopy, Fiber Optic Reflectance Spectroscopy, and X-Ray Fluorescence to Map and Identify Pigments in Illuminated Manuscripts," *Studies in Conservation* 59, no. 2 (2014): 91–101.

4
Alan Phenix, Getty Conservation Institute, personal communication, 2016.

5
Kristina A. Cheung et al., "Appendix IV: Materials Analysis," in Stephen Houston et al., *Temple of the Night Sun: A Royal Maya Tomb at El Diablo, Guatemala* (San Francisco: Precolumbia Mesoweb Press, 2015), 249–57.

Insights into Maya Ceramic Techniques with Digital X-Radiography

Megan E. O'Neil and John W. Hirx

The use of x-radiography in ceramic analysis for archaeology has a long history. Adrian Digby was an early adopter of this technology in his 1939 study of ancient Peruvian pottery techniques. In that project, Digby collaborated with Dr. H. J. Plenderleith of the British Museum in using x-radiography to study ancient Peruvian pottery, particularly in the examination of the attachment of vessel spouts to bodies for Nasca double-spouted vessels and Moche and Chimu stirrup-spout vessels. Their innovative research was interrupted by World War II and was not published until a decade later.[1]

Owen S. Rye greatly expanded the potential for analysis by taking x-ray images of modern pottery of known materials and manufacturing. He hypothesized that the pressure from hand-building techniques would leave distinctive marks on the clay, and that the building method would result in particular orientations of nonplastic inclusions that could potentially be seen in x-ray images. Rye was correct. For example, he found that coiling techniques could be discerned through the "horizontal preferred orientation of voids and mineral fragments," which also can be seen in cross sections under a microscope (fig. 1).[2]

Later, Giraud V. Foster used micro-xeroradiography on sherds to demonstrate that inclusions of alluvial sands and those prepared by humans (such as crushed ceramic or stone) could be distinguished, and that radiography could be effectively used in combination with visual and petrographic analysis for sorting and comparing sherds based on variations in their nonplastic inclusions.[3]

In 1990, Christopher Carr used improved x-radiography to study ceramics from the Middle and Late Woodland periods (200 BCE–1000 CE) in southern Ohio. He concluded that radiography was useful in revealing similarities and variations of ceramic formation techniques across space and time.[4]

Ina Berg's 2008 article expanded on these earlier studies. Her project created and x-rayed 101 vessels of different materials and techniques, analyzing the radiographs to look for the visibility of particular materials and evidence of facture.[5] She emphasized that advances in technology and software programs allowing manipulation of images enable finer distinctions of nonplastic inclusions than were previously possible (fig. 2).[6]

There has been limited study of pre-Columbian materials using x-radiography. Working with conservators at the Smithsonian Institution, Washington, D.C., Juliet Benham Wiersema employed the technology to study hand building, molds, and whistling mechanisms in Moche vessels from Peru.[7] In 2012, the Walters Art Museum, in Baltimore, studied some pre-Columbian ceramics with x-radiography, primarily to see damage and repair but also to discern manufacturing techniques, including slab construction for large West Mexican figures.[8] LACMA's Maya Vase Research

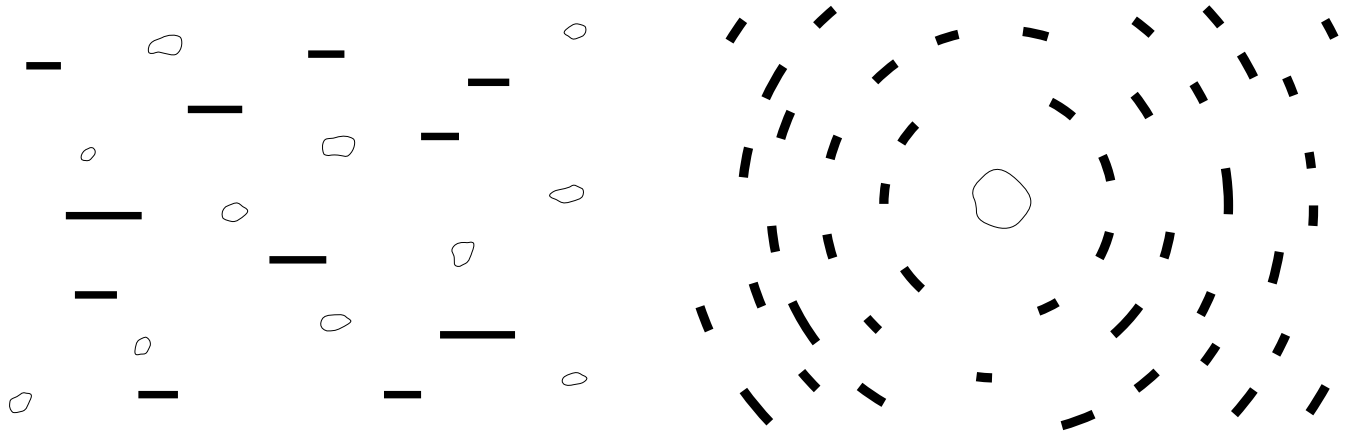
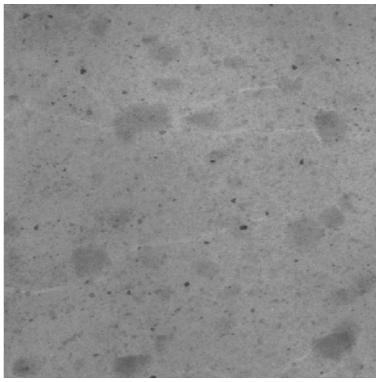
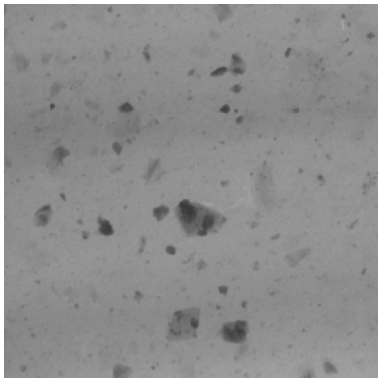


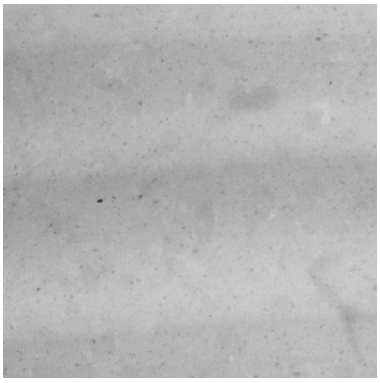
Fig. 1
Schematic drawings of radiographs of coil-built Mailu cooking pots, showing horizontal orientation of nonplastic inclusions in the wall (left) and spiral orientation in the base (right), redrawn after Wim Mumford and Owen Rye, and reproduced with the permission of the Australian National University. Source of original drawings: Owen S. Rye, "Pottery Manufacturing Techniques: X-Ray Studies," *Archaeometry* 19, no. 2 (July 1977), plate 3.



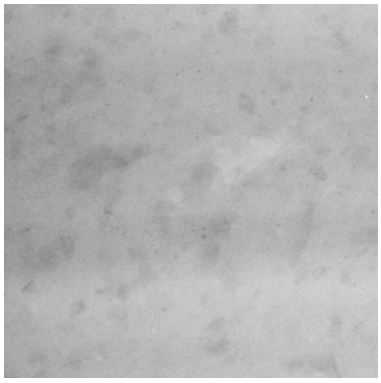
Marble



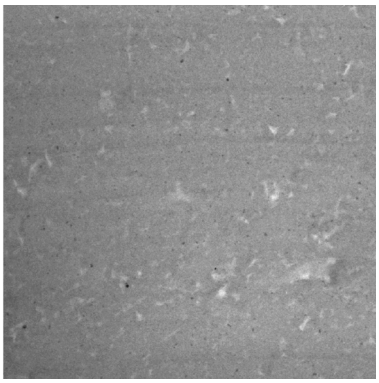
Granite



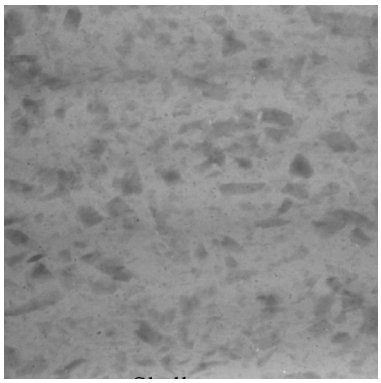
Quartz



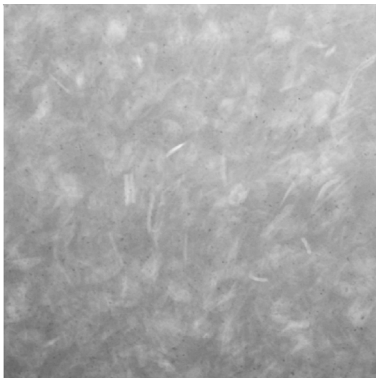
Sand



Grog



Shell



Straw

Fig. 2
Enhanced radiographs showing visibility of different tempering materials, as revealed by Ina Berg's experiments (images reproduced with permission of Ina Berg)

1
Adrian Digby, "Radiographic Examination of Peruvian Pottery Techniques," in *Actes du XXVIII Congrès International des Américanistes, Paris, 1947* (Paris: Musée de l'Homme, 1948), 605–8.

2
Owen S. Rye, "Pottery Manufacturing Techniques: X-Ray Studies," *Archaeometry* 19, no. 2 (July 1977): 205–7; Rye, *Pottery Technology: Principles and Reconstruction* (Washington, D.C.: Taraxacum, 1981), 61.

3
Giraud V. Foster, "Identification of Inclusions in Ceramic Artifacts by Xeroradiography," *Journal of Field Archaeology* 12, no. 3 (1985): 373.

4
Christopher Carr, "Advances in Ceramic Radiography and Analysis: Applications and Potentials," *Journal of Archaeological Science* 17, no. 1 (January 1990): 14–17, https://doi.org/10.1016/0305-4403(90)90013-U.

5
Ina Berg, "Looking through Pots: Recent Advances in Ceramics X-Radiography," *Journal of Archaeological Science* 35, no. 5 (May 2008): 1180, https://doi.org/10.1016/j.jas.2007.08.006.

6
Ibid., 1177.

7
Juliet Benham Wiersema, "The Architectural Vessels of the Moche of Peru (CE 200–850): Architecture for the Afterlife" (PhD Diss., University of Maryland, College Park, 2010).

8
Julie Lauffenberger, "Approaches to Authentication," in *Exploring Art of the Ancient Americas: The John Bourne Collection*, ed. Dorie Reents-Budet, exh. cat. (Baltimore: Walters Art Museum, 2012), 196–98; Lauffenberger, "Mother and Child," in Reents-Budet, *Exploring Art of the Ancient Americas*, 67–68.

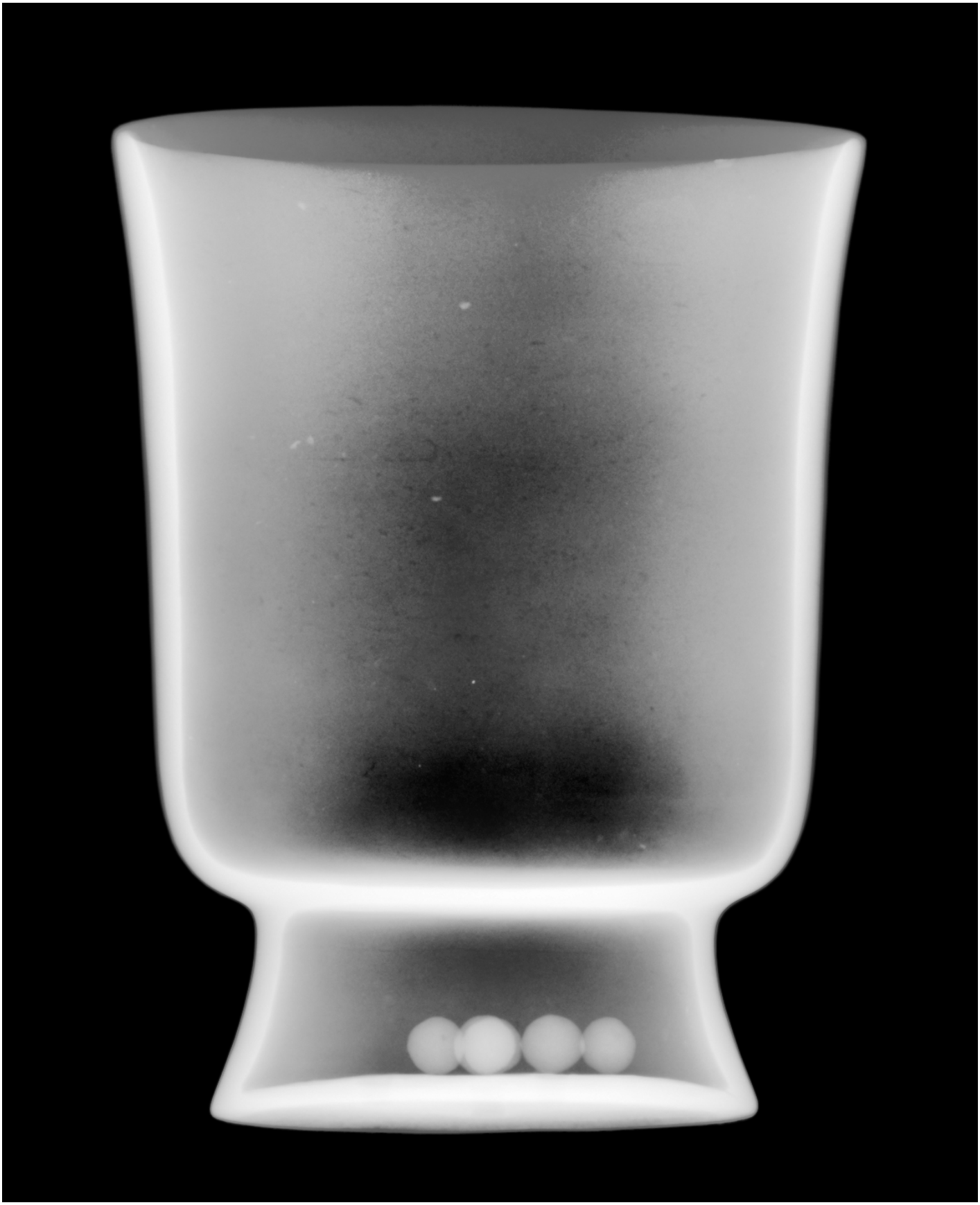
Project used digital x-radiography as one tool in a suite of noninvasive techniques to study ceramic vessels in the permanent collection. The digital radiographs were manipulated in image-processing programs that enhance features and allow for the study of physical composition and properties without physically sampling the objects (fig. 3). The LACMA project was able to capitalize on advances in digital x-radiography and applied this technology—in tandem with visual and tactile analysis—to the study of Maya ceramics and manufacturing techniques, focusing particularly on nonplastic inclusions in clay mixtures, building techniques such as coiling, evenness of potting, and inclusion of rattles as well as other features. Fractures visible in the radiographs also can reveal clues about manufacture as well as condition of the pots, resulting in insight into the life histories of these pieces.

Other scholars have explored some of the same questions regarding ceramic fabric and building techniques using methods such as visual analysis of the edges of sherds and analysis with a petrographic or polarizing microscope of cross sections and thin sections taken from sherds.[9] The present study, however, does not employ those techniques, because it takes as its subject whole vessels whose integrity as cultural artifacts and museum objects is paramount. Digital x-radiography, in conjunction with visual and tactile analysis, allows for the study of materials and manufacturing techniques without dismantling vessels, thus providing researchers with the opportunity to think more holistically about the objects. Together, these methodological approaches enable scholars to get closer to the hands of the ancient potters who made the extraordinary pieces addressed in this study.[10]

9
For example, see Anna O. Shepard, *Ceramics for the Archaeologist* (Washington, D.C.: Carnegie Institution, 1956); Ronald L. Bishop, Robert L. Rands, and George R. Holley, "Ceramic Compositional Analysis in Archaeological Perspective," in *Advances in Archaeological Method and Theory*, vol. 5, ed. Michael B. Schiffer (New York: Academic Press, 1982), 275–330; James B. Stoltman, "The Role of Petrography in the Study of Archaeological Ceramics," in *Earth Sciences and Archaeology*, eds. Paul Goldberg, Vance T. Holliday, and C. Reid Ferring (Boston: Springer, 2001), 297–326, https://doi.org/10.1007/978-1-4615-1183-0_11; Ian K. Whitbread, "Fabric Description of Archaeological Ceramics," in *The Oxford Handbook of Archaeological Ceramic Analysis*, ed. Alice M.W. Hunt (Oxford: Oxford University Press, 2017), 202–7.

10
For detailed discussion of the authors' findings, see John W. Hirx and Megan E. O'Neil, "Building the Ceramic Vessel," in this volume.

Fig. 3
Unprocessed (left) and processed (right) x-radiographs of “The Perfect Pot” (cat. 18)



4 Building the Ceramic Vessel

John W. Hirx and Megan E. O'Neil

A study incorporating x-radiography, stereomicroscopy, and visual and physical examination of Classic-period (250–900 CE) Maya ceramic vessels in the LACMA collection indicates that the hand-building technique for fabricating vessels from coils of clay predominated.[1] However, evidence reveals diverse applications of that technique as well as great variation in the clay bodies used to make the vessels.

The Clay Body

As with potters across the world and throughout time, Maya potters had to find sources of clay with which to form their vessels.[2] Depending on the qualities of the clay deposits, potters made more or fewer modifications to produce a working clay body. Typically, clays are dug and brought to the potter's studio or compound. The clays are placed in settling tanks filled with water, in which the chunks of clay are stirred and allowed to settle. During this process, called flotation, organic matter, such as leaves, twigs, and roots, floats to the top of the water and is skimmed off. This process is repeated until all visible organics have been removed. Also during this time, rocks and pebbles, heavier than clays, settle to the bottom of the tank.

After this initial processing, the potter needs to draw excess moisture from the clay slurry. Potters around the world achieve this through various means, including manually removing the slurry from the tank and placing it on fabric or wooden or plaster boards. Once the excess water has been extracted, the potter wedges the clay to render it homogeneous in texture and to eliminate air bubbles. While wedging the clay, the potter assesses its qualities. It is too sticky to work with? Is it too short, meaning that it easily falls apart? Will the clay make it through the full fabrication and firing cycle to produce a fault-free vessel or object? If the answers are no, no, and yes, then the potter or clay worker has found a naturally occurring clay for direct use. This, however, is rarely the case, and potters often add materials to improve the workability of the clay and to help with shrinkage and thermal shock during the drying and firing processes.[3]

The materials added to the clay are called nonplastic inclusions in the largest sense because they resist deformation, unlike clay. Nonplastic inclusions can encompass organic and inorganic materials. Potters may incorporate them as siccatives—or drying agents—to reduce tack or to control shrinkage and thermal shock during drying and firing. Nonplastic inclusions also may occur naturally in the clay. Archaeologists generally refer to nonplastic inclusions as "temper," because the materials alter the qualities of the clay. However, since some inclusions occur naturally, this term can be misleading.[4] Furthermore, potters also may have added other substances, such as acids, salt, and organic materials, as well as other clays, which neither visual or tactile analysis nor radiographs can distinguish.[5]

Potters employ a variety of organic and inorganic materials as siccatives. Around the world, commonly used organic siccatives include chopped hay, straw, rice, and seeds. The ancient Maya would have used organic materials found in their environment, such as grasses and other plant fibers, feathers, and calcined and crushed shell.[6] These materials help make the clay body more workable, but many burn out during firing. Inorganic siccatives do not burn out during firing and can be seen through visual analysis of sherds and in radiographs. Grog counts among the more common inorganic siccatives. It consists of a low-fire ceramic sand obtained by crushing and grinding an unglazed ceramic object—generally one considered a failure in the firing process—and sieving those ground particles into desired sizes. The porous nature of ground ceramics makes grog a practical siccative, and it helps the clay structurally, especially as vessel or object size increases.

1 This chapter combines personal knowledge of ceramic production by John W. Hirx, a conservator and potter, with information gleaned from our collaborative analyses of the Maya ceramics in the LACMA collection, as well as data provided by scholars studying ancient pottery and ethnographies of ceramic production by Maya people from the nineteenth century until today.

2 For a description of the clay and temper sources and preferences of potters from Ticul, in the Mexican state of Yucatan, in the 1960s, see Dean E. Arnold, *Maya Potters' Indigenous Knowledge: Cognition, Engagement, and Practice* (Boulder, CO: University Press of Colorado, 2018), 79–120.

3 Carla M. Sinopoli, *Approaches to Archaeological Ceramics* (New York: Plenum Press, 1991), 9–15.

4 Prudence M. Rice, *Pottery Analysis: A Sourcebook*, 2nd ed. (Chicago: University of Chicago Press, 2015), 83–84.

5 Ibid., 69, 79, 81.

6 Anna O. Shepard, *Ceramics for the Archaeologist* (Washington, D.C.: Carnegie Institution of Washington, 1956), 26–30.

Potters may add inorganic nonplastic inclusions specifically to strengthen the clay body. These include grog, quartz sand, volcanic ash and pumice, feldspathic sands, mica, and crushed rock, none of which burn out.[7] Dean Arnold notes that contemporary potters in Ticul, in the Mexican state of Yucatan, obtain their temper from special mines. One type of inorganic nonplastic inclusion that the Ticul potters use is *sascab* (*sah kab* in Yucatec Maya), a naturally occurring limestone marl, which they mix with *sak lu'um* (literally, "white earth"), identified as palygorskite. They use these materials to strengthen vessels.[8] Ancient potters may well have preferred specific sources too. The sands and ash have no siccative properties. Unlike organic nonplastic inclusions that can compress to a certain extent as the object dries and shrinks, inorganic nonplastic inclusions retain their size. Instead, the clay body shrinks around them. The shrinkage causes the formation of minute cracks that radiate from the inclusions and thus serve as channels for moisture to escape during drying and firing. The addition of inorganic nonplastic inclusions can decrease the overall shrinkage of some clays between the wet and dry states. An additional benefit of the inclusions comes from their ability to confer thermal shock properties to the object during firing, increasing the probability that the object will successfully pass through the process without exploding.

7 Rice, *Pottery Analysis*, 79, 81.

8 Arnold, *Maya Potters' Indigenous Knowledge*, 73–74, 88–90, 116. For earlier references to *sascab* used as pottery temper, see Raymond H. Thompson, *Modern Yucatecan Maya Pottery Making*, *Memoirs of the Society for American Archaeology*, no. 15 (Salt Lake City: Society for American Archaeology, 1958), 68–69.

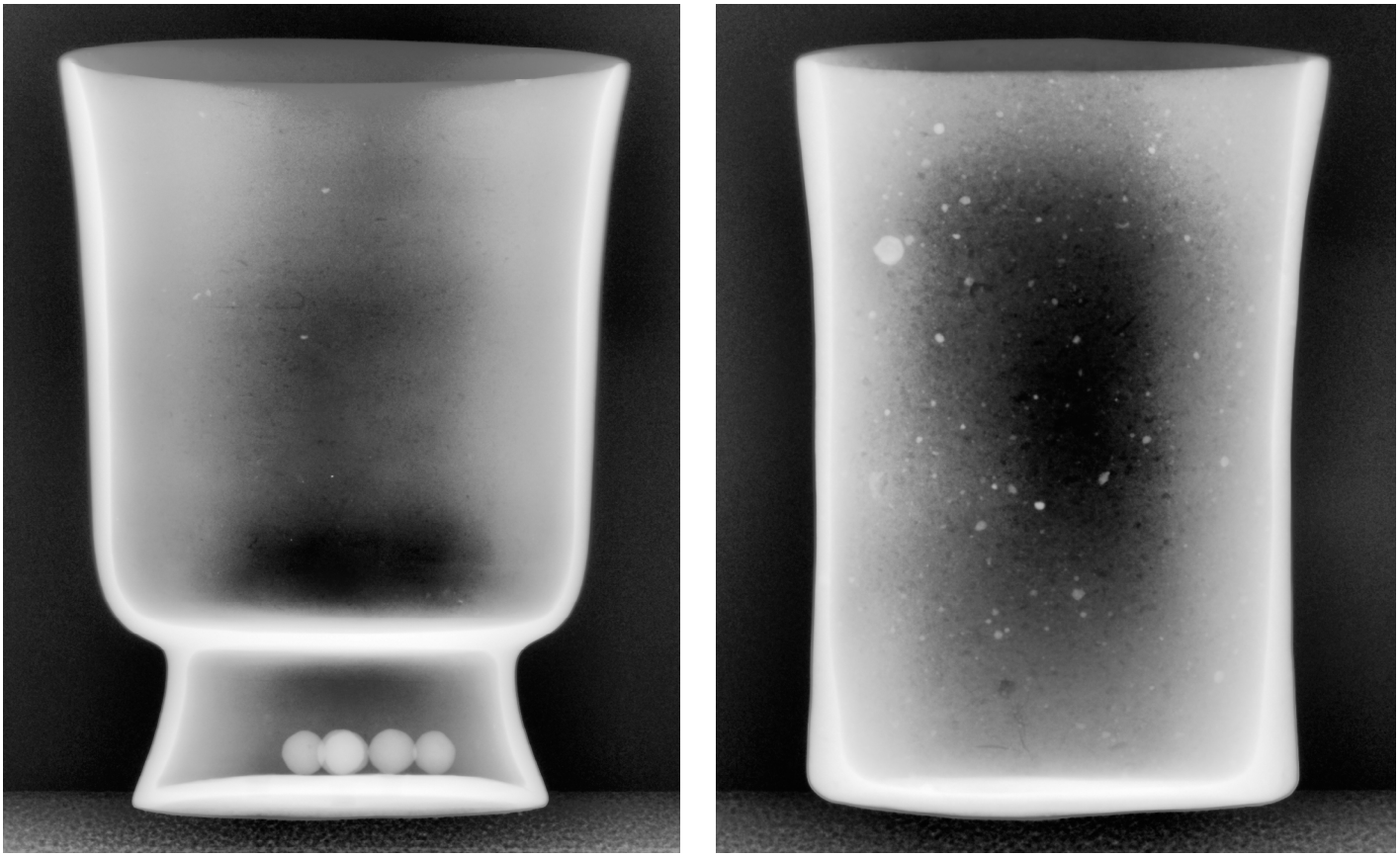


Fig. 1
Radiographs of "The Perfect Pot" cat. 18 (left) and cat. 3 (right) revealing differences in nonplastic inclusions and in the evenness of the walls

The visual and radiographic evidence for the use of inorganic and organic nonplastic inclusions in this book's study set of Maya ceramics varies from vessel to vessel. Radiographs allow researchers to distinguish both types of inclusions by studying their radiotransparency and radiopacity (the extent to which they attenuate radiation), their shapes and sizes, and their distribution within the ceramic matrix. Burned-out organic inclusions leave voids that appear black in radiographs; if close to a vessel's surface, they can pop out and leave voids visible to the naked eye. Light areas in radiographs indicate radiopaque materials, such as sand or crushed ceramics. The radiographs of some Maya vessels show that their potters likely exercised tight control over nonplastic inclusions in terms of their shapes, sizes, radio properties, and distribution, but others show less control, and, indeed, every variable may differ (fig. 1). Multiple examination approaches employed in this study suggest that Maya potters used different clay sources with varying qualities that required amendments.

For example, the radiograph of the *Vase of the Eleven Gods*, a squared vessel likely from Naranjo, Guatemala, shows a manipulated but heterogeneous clay body (fig. 2; see also cat. 10). Some inclusions appear to be grog. Note the space around them, where the clay shrank away from the inclusions while their size and shape remained stable. The whiter inclusions consist of non-ceramic and nonporous material, probably incorporated to give the clay body structure and help with thermal shock. Grog also appears in radiographs of a vessel with a scene related to warfare and offering, also likely from Naranjo (cat. 8). The radiographs of a matching codex-style bowl and cylinder vessel show their markedly similar clay bodies (fig. 3; see also cats. 3–4). This aligns with the conclusion from neutron activation analysis that they were possibly made from the same clay mixture.[9] These clay bodies exhibit less evidence of manipulation than those of the aforementioned vessels and display a seemingly random distribution of nonplastic inclusions. Such findings may indicate a lack of any desire or attempt to levigate the clay or evenly distribute siccatives or temper. In contrast, the clay body of what the collaborative team has nicknamed "The Perfect Pot" (cat. 18), a cylinder vessel with a pedestal base, contains few inclusions, suggesting that the potter may have sought a particular clay or cleaned it thoroughly through levigation, and that the potter likely had good control of the firing conditions.

9 Dorie Reents-Budet et al., "Codex-Style Ceramics: New Data Concerning Patterns of Production and Distribution" (paper, XXIV Simposio de Investigaciones Arqueológicas en Guatemala, Museo Nacional de Arqueología y Etnología, Guatemala City, July 19, 2010), http://www.mayavase.com/codex.pdf.

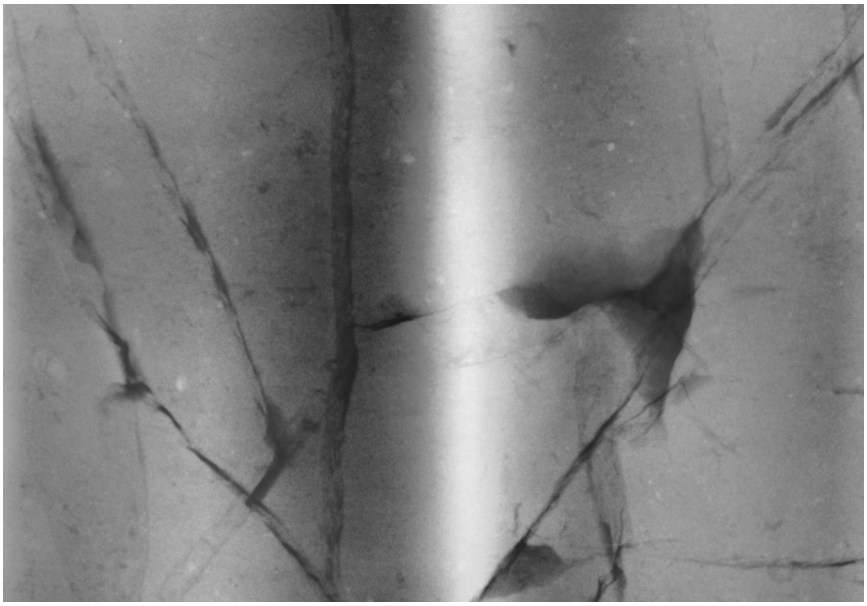
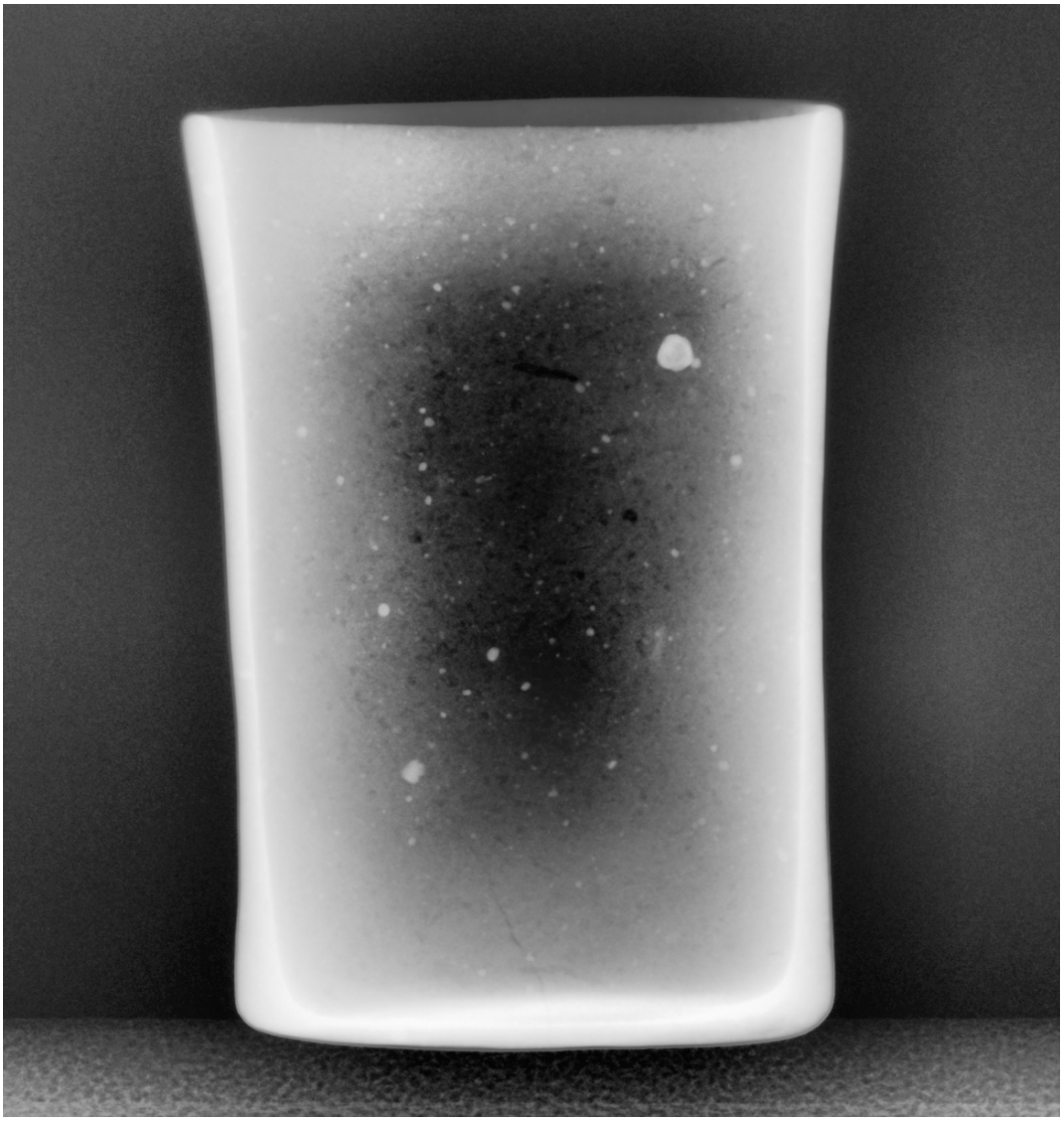


Fig. 2
Detail of a radiograph of the *Vase of the Eleven Gods* (cat. 10) showing nonplastic inclusions, some of which are grog



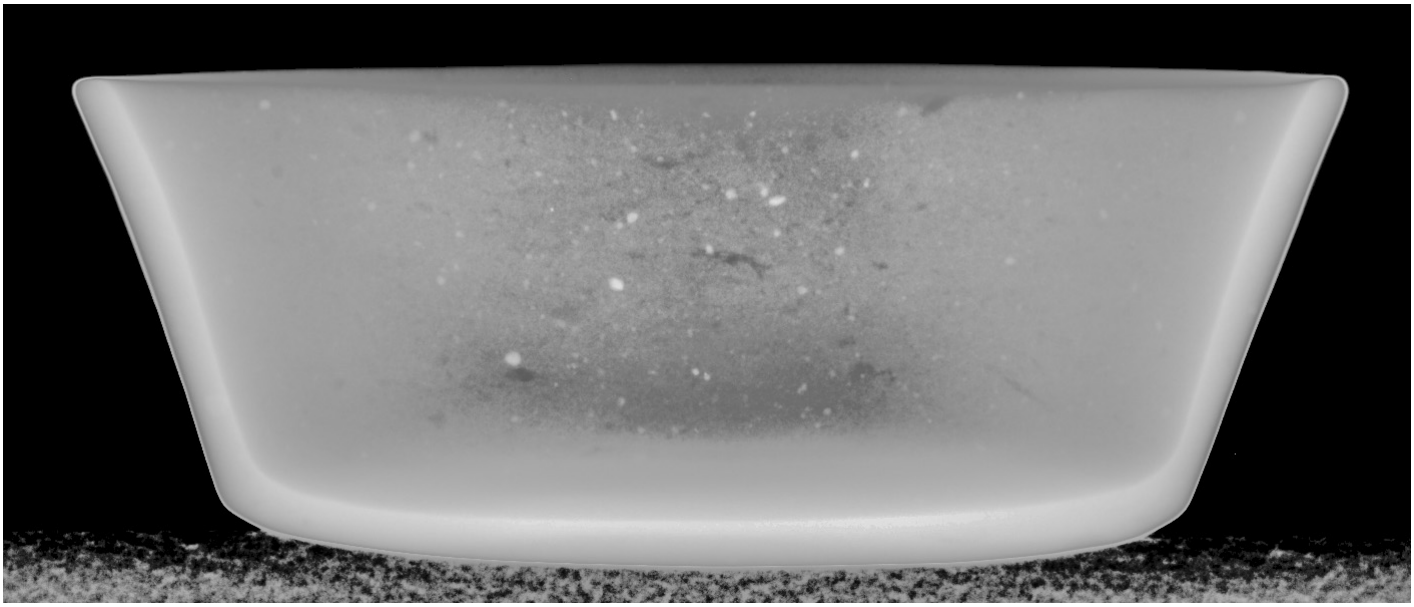


Fig. 3
Radiographs of cat. 3 (top) and cat. 4 (bottom) showing similar distribution of nonplastic inclusions

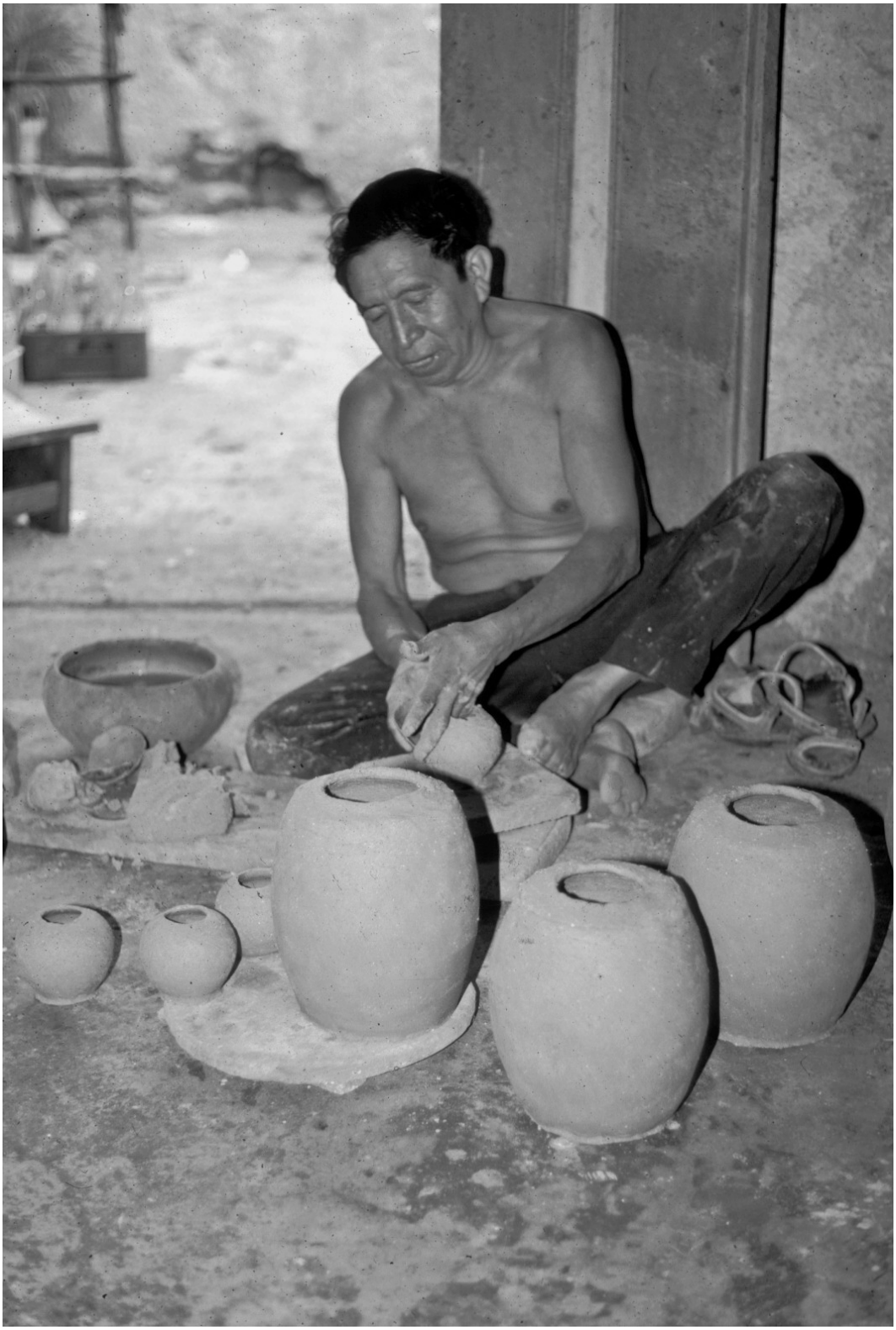


Fig. 4.
A potter named Claudio Huicab using a traditional *k'abal* in Ticul, Yucatan, in 1984—his foot works the turntable while he shapes the vessel with both hands; in this case, the potter works seated on the floor (photograph by Dean E. Arnold). Source: Dean E. Arnold, *Maya Potters' Indigenous Knowledge: Cognition, Engagement, and Practice*, University Press of Colorado, Boulder, 2018, Figure 6.2.

Making a Vessel

After the preparation of a workable clay body, a potter using the coil-building technique rolls the clay into ropes to form the coils. Radiographs of the majority of vessels in this book's study set show evidence of coil building (cats. 1–6, 8–11, 17–21, and 24–25). The radiographs of other vessels in the study currently appear to be nondiagnostic with respect to building technique.

The production of coils can entail either rolling clay on a dry, nonstick surface or racking a lump between opposing hands to first create ropes of clay. No apparent evidence in the vessels indicates which technique (or techniques) Maya potters used. A potter rolls or cuts the ropes to a length and diameter appropriate for the circumference and wall thickness of the vessel under construction. Looping those ropes into coils of uniform diameter requires skillful hands. Consistent, evenly rolled coils generally lead to consistent wall thickness of formed vessels, which in turn leads to more even drying, fewer shrinkage cracks, and increased probability of successful passage through firing.

The forming of Maya vessels likely began with the creation of the floor. One approach was to press or pat a clay ball into a disk or pancake form, sometimes using a mold. Dorie Reents-Budet has noted that many cylinder vessels "characteristically crack where the bottoms were attached to the first coil of the vessel wall."[10] That particular crack pattern may indicate that the vessel floor was constructed first with a solid disk. The aforementioned vase with a warfare and offering scene (cat. 8) provides an example of a vessel apparently made in this way. Alternatively, a vessel floor may consist of a coil arranged into a spiral, typically on a flat surface or in a low round dish that also can function as a turning device. Evidence of spiral coiling appears in radiographs of the floors of multiple vessels in this book's study set (cats. 2, 9–11, 20, and 24).[11] These determinations derive from the spiral orientation of nonplastic inclusions, as seen in the radiographs, interpretations often strengthened by review of corresponding fractures.

The technology of the Classic-period Maya did not include a true potter's wheel. However, as early as the mid-nineteenth century, observers of Maya potters in Yucatan mention the use of a turning device called a *k'abal* (sometimes written as *kabal*; fig. 4).[12] The *k'abal* consists of a rectangular or circular piece of wood that potters turn with the hand or foot. (Its name derives from the Yucatec Maya word for those appendages.) Though not secured with a pivot, if kept in place and steadily manipulated, the device can allow the potter to produce radial symmetry. The antiquity of the *k'abal* is debated; it may or may not have existed among the pre-Hispanic Maya.[13] Regardless, ancient potters undoubtedly would have used other turning devices, such as plates, dishes, or large fragments of similar vessels. Analyses of ancient Maya ceramics in the LACMA collection indicate careful forming of vessels with distinct radial symmetry that appear to have been made with a turning device, however simple it may have been. On a lidded vessel with images of an open hand (cat. 20), the pronounced coiling of the vessel floor appears clearly, both in the radiograph and upon visual inspection (fig. 5). These unsmoothed coils consist of narrow, rolled clay laid pseudo-concentrically; the potter appears to have pulled the bowl counterclockwise to arrange the spiral.

10 Reents-Budet, *Painting the Maya Universe: Royal Ceramics of the Classic Period*, exh. cat. (Durham, NC: Duke University Press in association with Duke University Museum of Art, 1994), 210, 231n91.

11 For techniques of interpreting radiographs, see Megan E. O'Neil and John W. Hirx, "Insights into Maya Ceramic Techniques with Digital X-Radiography," in this volume.

12 See Henry C. Mercer, *The Kabal; or, Potter's Wheel of Yucatan* (Philadelphia: H.C. Mercer, 1897): 63–64, 69; George W. Brainerd, *The Archaeological Ceramics of Yucatan* (Berkeley: University of California Press, 1958), 66–68; Thompson, *Modern Yucatecan Maya Pottery Making*, 74–80; Shepard, *Ceramics for the Archaeologist*, 61–63; Arnold, *Maya Potters' Indigenous Knowledge*, 138–40.

13 Thompson, *Modern Yucatecan Maya Pottery Making*, 76.

As a vessel grows in size, a coil-building potter either continues the spiral upward or stacks individual coils. With one hand turning the developing vessel, the other hand pinches and lutes the coils together, joining them into one mass. If the potter properly and consistently prepared the clay with even moisture throughout, then the coils typically lute completely. Uneven moisture, insufficient wedging, or superficial luting could all lead the coils to separate during drying and firing. Radiographs show evidence of coil building in vessel walls by revealing the orientation of nonplastic inclusions—particularly the organic ones—which tend to align horizontally along the axis of each coil. Additionally, the technique can betray itself by providing more obvious physical evidence, such as ridges, often on the interior, resulting from not fully smoothing the luted coils, or cracks between coils that may result from the manufacturing process, especially as vessels increase in size. For example, a potter can make a small item in one sitting; however, larger vessels must dry to a certain extent between courses of coils in order for the walls to stiffen enough so as not to collapse—a state of dryness referred to as "leather hard." If a potter adds coils after the vessel has become too dry, a fault crack forms, which can easily propagate during drying and firing.

Examination of objects at LACMA has revealed both variations of coil building mentioned above: stacked and spiral. A tripod vessel with a supernatural palace scene and cacao tree shows radiographic evidence of stacked coils (fig. 6; see also cat. 17). Instead of a continuous, upwardly spiraling coil, individual rings are controllably positioned, one on top of the other, and joined end to end. In the radiographs, dark voids (from burned-out organic material) display horizontal orientations, and the white, more radiopaque inclusions create horizontal bands. These parallel bands evince manufacture with stacked rings rather than a spiral coil. The first few inches of the walls are perpendicular to the floor, indicating that the potter stacked similarly sized coils. Then, to evenly taper the walls, the potter used progressively smaller rings, stacking each slightly toward the inside of the coil below. In the case of this vessel, the potter somewhat aligned the joined ends of each coil, forming an irregular yet continuous line from bottom to top, rather than placing the joins randomly.

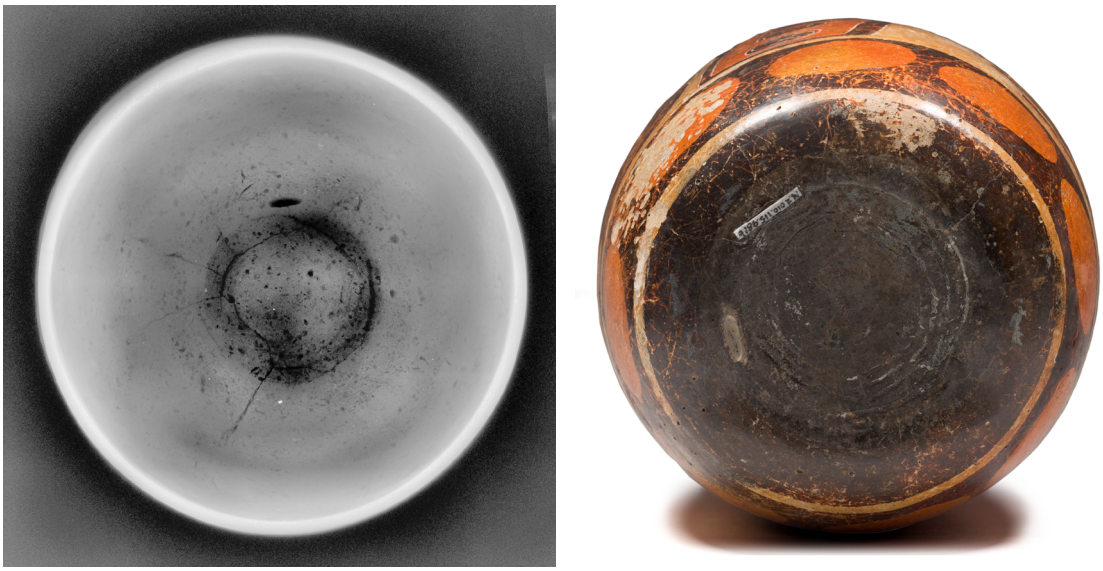


Fig. 5
Radiograph and photograph showing unsmoothed coiling on the bottom of a lidded vessel with images of an open hand, cat. 20

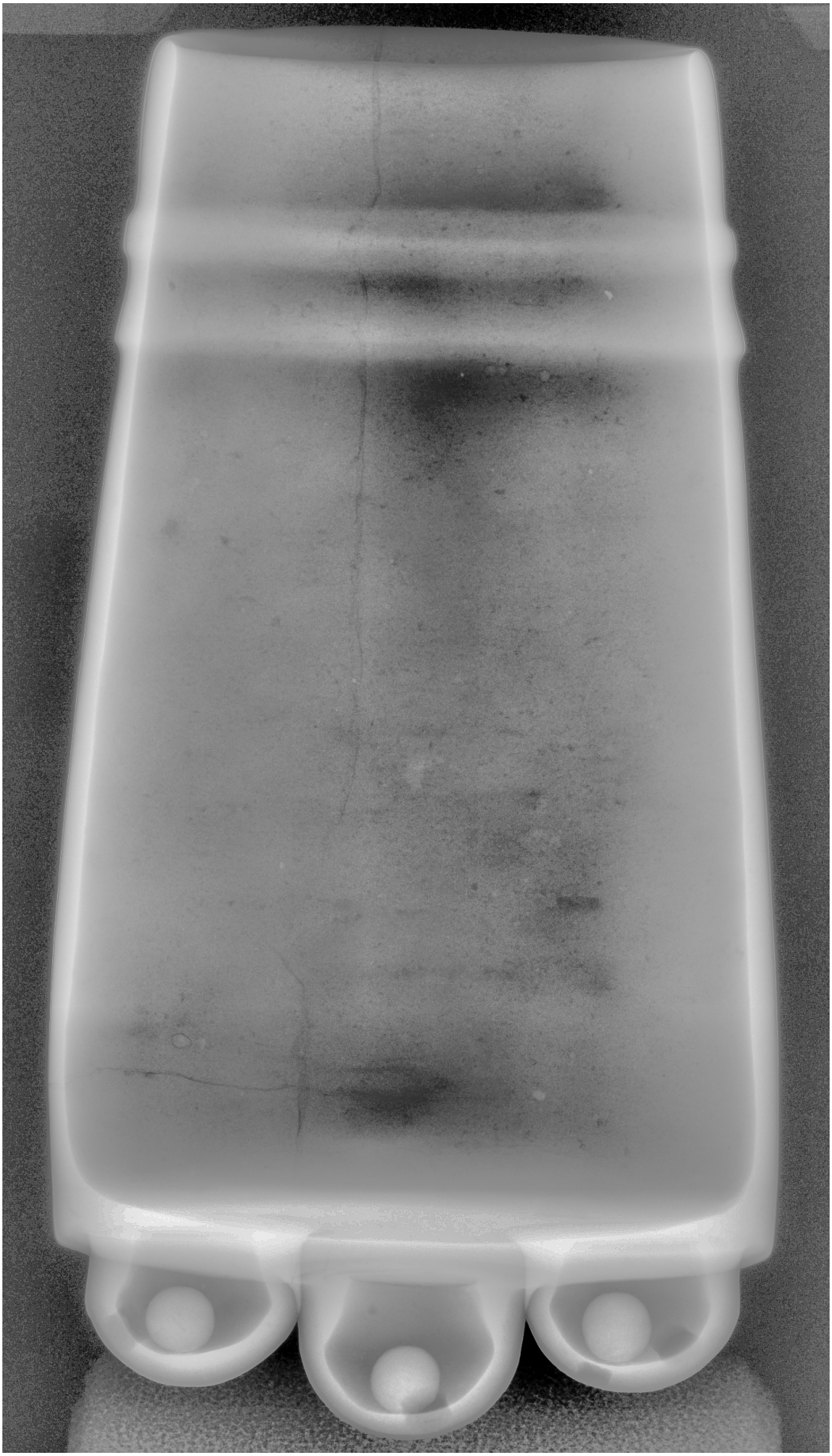


Fig. 6
Radiograph of a tripod vessel with a supernatural palace scene and cacao tree (cat. 17) showing horizontal banding of inclusions, which indicate stacked coils, and vertical and horizontal cracks

This construction technique caused an irregular line of weakness on the vessel; indeed, at some point in the object's history, the force of an apparent blow to the lower rim of the vessel coursed through the join lines, resulting in a long vertical crack. The break also propagated horizontally on the side wall near the vessel's base, running parallel to the bands observed in the radiograph. These fracture patterns thus align with what the radiographs reveal about the vase's manufacture. This evidence contradicts a previous interpretation that the presence of a "single longitudinal (often hairline) crack" from rim to base observed in many cylinder vessels indicated the join point of a single slab of clay wrapped into a cylinder.[14] The LACMA project's work with x-radiography reveals that even cylinders with a vertical crack may have been made with coils.

Spiral coiling, by virtue of its use of a continuous length of clay, can avoid compromising a vessel's integrity through the orientation of join points. Two works in LACMA's study provide possible evidence for the spiral coiling of vessel walls (cats. 1 and 5). Radiographs of both vases reveal the telltale horizontal orientation and banding of nonplastic inclusions, but visual examination of the objects also shows that one side of each vessel stands taller than its opposite. This discrepancy suggests manufacture with a spiraling coil that ended higher on one side of each vase.

The squared *Vase of the Eleven Gods* represents another variation of the coil-building technique, square coiling. As in the making of other vessel floors, the potter first created a coiled spiral, but in this case the artist made it larger than the vessel's desired footprint and then cut from this circle a square floor. The radiograph of the floor clearly shows the spiral from the coiling process as well as variation in radiodensity, likely caused by the use of a baton to strike the clay and force the coils to merge (fig. 7). The radiograph and visual analysis also show curving cracks that end along the perimeter of the square (as opposed to continuing in a circle), which strengthens the observation that the vessel floor consists of a squared form cut from a coiled circular disk.

After forming the base, the potter added coils onto the top of the square floor, following the edges to create a somewhat squared cylinder (fig. 8). To further square the cylinder, the potter used the paddle-and-anvil technique, holding an anvil against the inside walls while slapping their exterior with a paddle. This percussive activity compresses the clay, drives air out, and presses the coils together. The paddle also helped form the squared exterior corners, while the inside corners retain the curve of the coils from the wall fabrication (figs. 8–9). A vase with supernatural birth scenes, another squared vessel from the Naranjo region, was built in a similar manner, with a spiral floor followed by square coiling that was then shaped by paddle and anvil (cat. 11).

X-radiographs may reveal evenness of potting as well as shaping and finishing techniques. After completing the basic structure of a coil-built vessel and luting as desired, a potter may further shape the clay with his or her hands and tools called ribs. Shaping by hand may include pinching, pulling, and stretching vessel walls. Ribs made from dried gourds, wood, or other materials are used to shape, scrape, smooth, or cut clay. A well-crafted vessel requires planning—for instance, if the finished form includes flared walls, maintaining a consistent final wall thickness throughout for even drying and firing would require leaving the to-be-stretched areas thicker prior to rib work; during the stretching, the walls in those areas will thin. Radiographs of the Perfect Pot reveal an elegant structure with even walls (fig. 1 [left]). It likely started out as a cylinder, and the artist used pinching and stretching to carefully distort it into the new form. The slightly thinner walls where it bulges out at the bottom

14 Sarah Nunberg, "New Insights from Conservation and Materials Analysis of Maya Vases at Princeton," in *Dancing into Dreams: Maya Vase Painting of the Ik' Kingdom*, ed. Bryan Just, exh. cat. (Princeton, NJ: Princeton University Art Museum; New Haven, CT: Yale University Press, 2012), 227.

and where it flares at the top suggest that a rib was used in this pot to stretch the wall and create the curve at the base. For the vase with a warfare- and offering-related scene (cat. 8), a very light vessel with relatively thin walls, radiographs show a coil-built structure thinned by scraping, which drags inclusions through the clay, creating lines (fig. 10). In contrast to these carefully formed pots, others reveal less precision in their manufacture. Radiographs of the codex-style cup mentioned above (cat. 3, fig. 1 [right]), for example, display uneven wall thickness throughout and an inconsistent rim. For this and other vessels painted in this style, Maya artists appear to have focused not on crisp pots but instead on the painted images and texts.

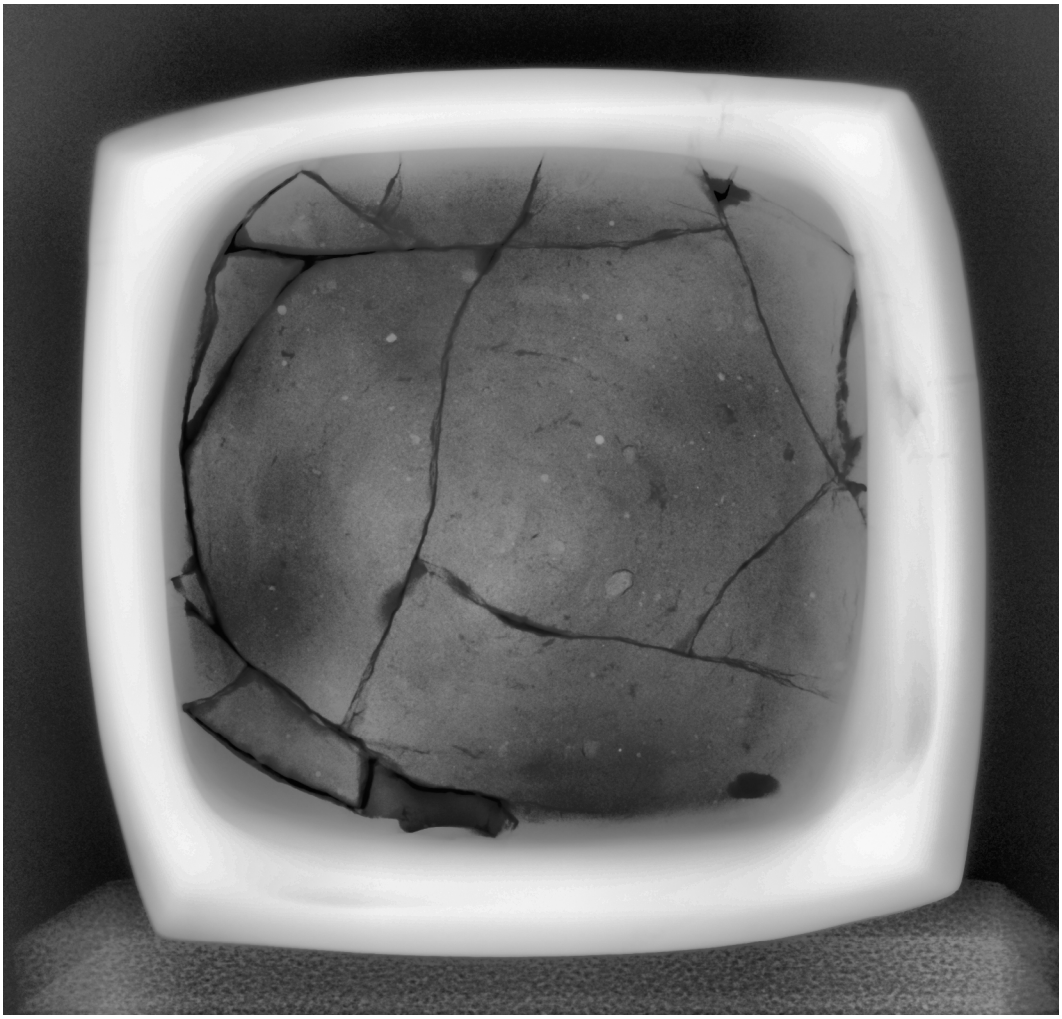


Fig. 7
Radiograph of the bottom of the *Vase of the Eleven Gods* cat. 10 showing spiral orientation of nonplastic inclusions in the base, curving cracks, and evidence of paddle-and-anvil shaping

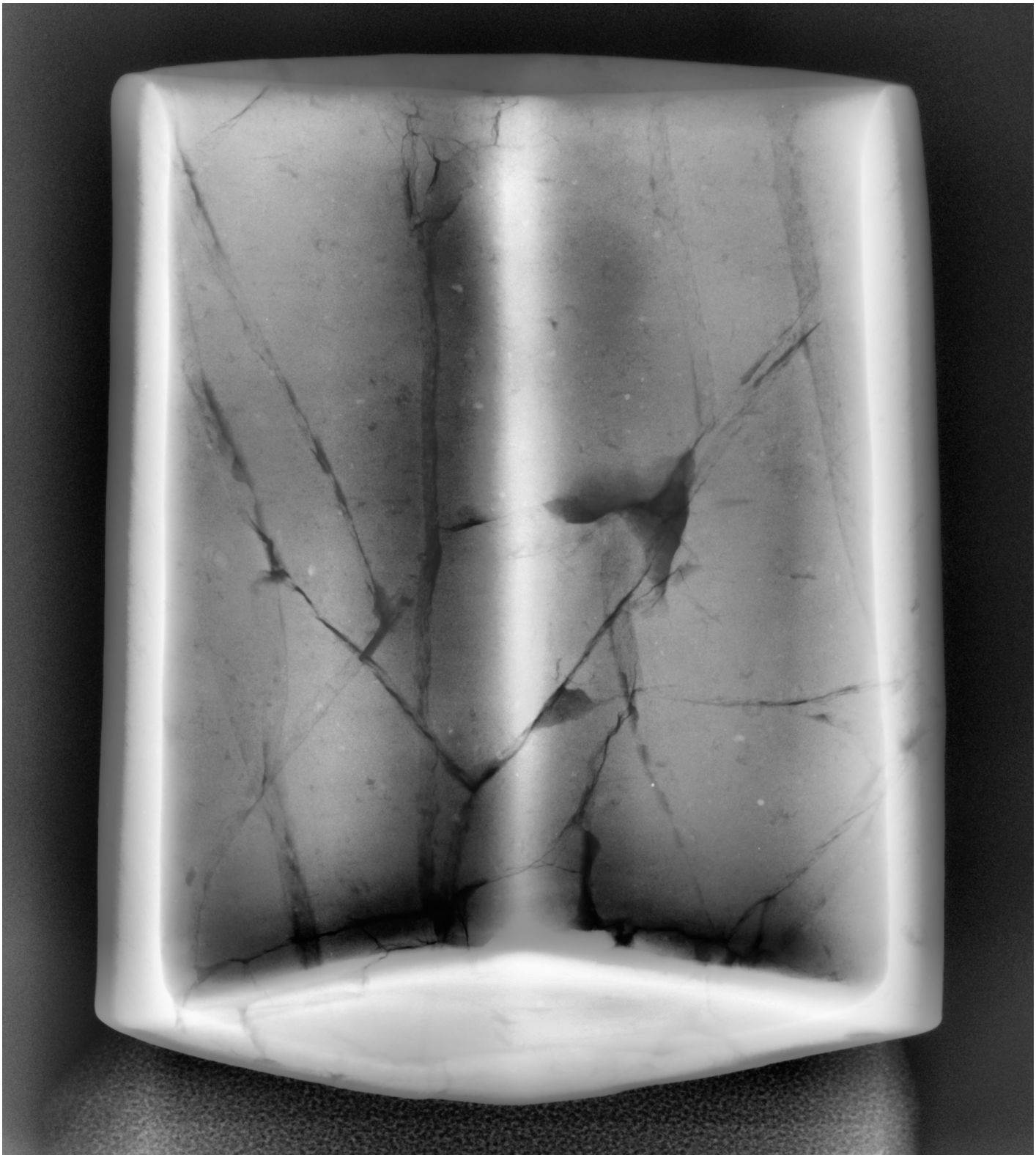


Fig. 8
Radiograph of the *Vase of the Eleven Gods* cat. 10 showing horizontal nonplastic inclusions, which indicate square coiling

Fig. 9
View of the *Vase of the Eleven Gods* cat. 10 showing curved interior corners

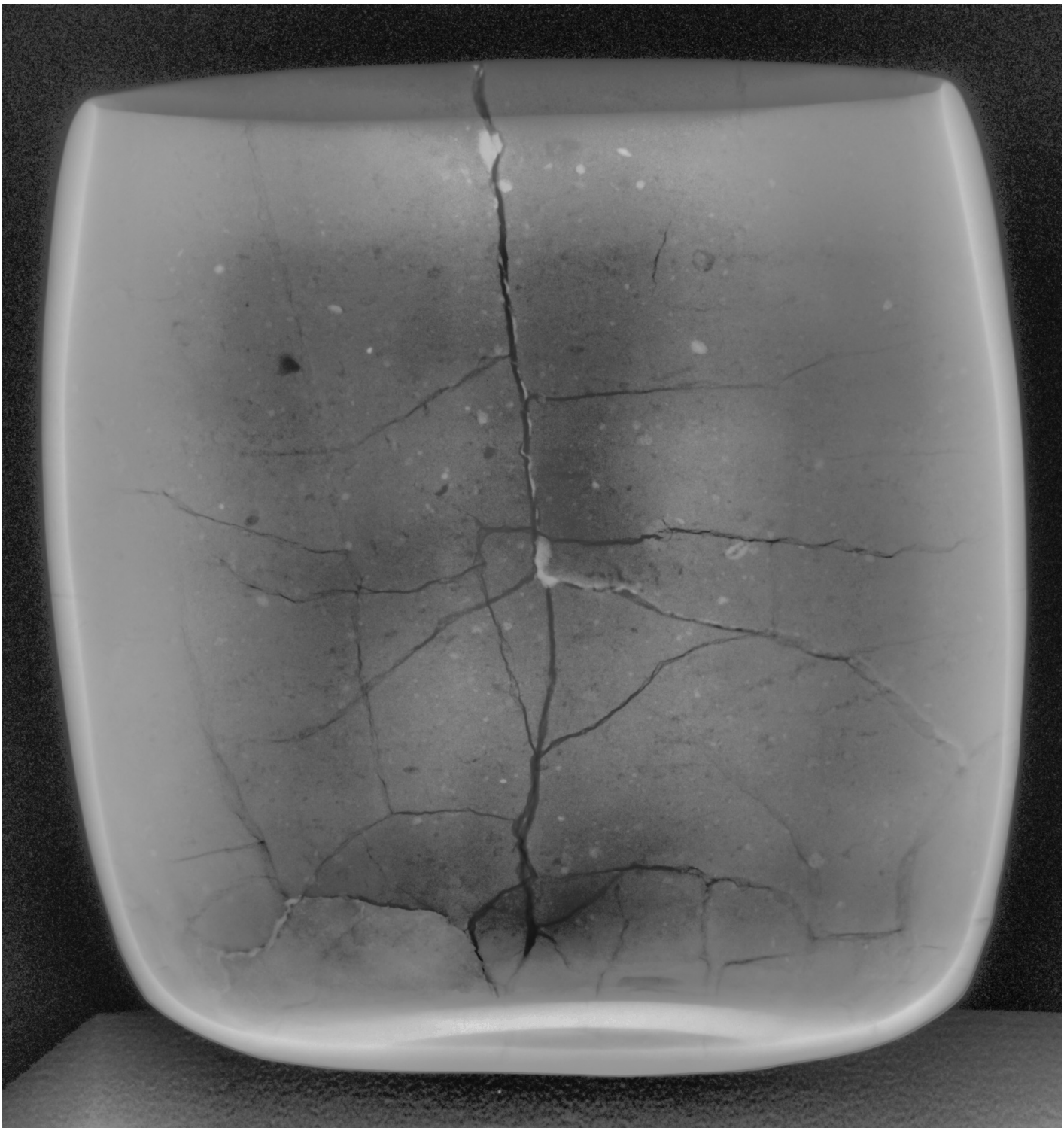


Fig. 10
Radiograph of cat. 8 showing thin walls

In the process of building a vessel, Maya potters sometimes added a pedestal base, double floor, or feet that hold clay balls, or rattles, as functional and decorative embellishments. The Perfect Pot (cat. 18) and a cylinder vessel with a dynastic list of the Kaanul (Snake) kingdom (cat. 2) have chambers holding multiple rattles, and the three feet of the cacao-tree vessel (cat. 17) contain one rattle each (figs. 6 and 11). As seen in the photograph and x-ray of the Perfect Pot, a fabric impression on the base may indicate construction from a true rolled slab flattened on cloth. The artist exercised great care in attaching the pedestal foot to the cylinder and sealing five balls into the resulting chamber. Potters would have had to cover the clay balls with something—such as dried clay or paper—to keep them from sticking. Some feet function more simply to support the vessel, but potters still made concerted efforts to clean up the sites of attachment. On the cacao-tree vase, the joins of the feet (made as pinch pots) form perfect circles, apparently achieved by attaching each foot and then turning the vessel while scraping away excess clay. Each seems to have been executed with one continuous stroke, deeper toward the center, with the tool or finger lifted at the end. This precision could indicate that, to attach these feet, the potter made use of a turning device. On the lids of covered vessels, the potter often added a knob for lifting; this could take the shape of a human or animal head or a rounded knob or ring. In the radiographs of the lid for the vessel with images of an open hand (cat. 20), a clear build-up of clay occurs where the potter pressed the ring handle onto the lid.

In addition to the techniques described above to mix the clay and construct the vessels, Maya artists used a variety of techniques to decorate them. In some cases, they outlined painted images and inscriptions with carving and incising, as seen on the open-hand vessel (cat. 20). While this study focuses on fine polychrome painted ceramics, on many other vessels in the Maya corpus, artists created images or texts entirely out of carving, incising, and the juxtaposition of varying textures, as opposed to color application.[15]

After forming the vessels, artists frequently decorated them with colored engobes made of clay thinned with water and often combined with pigments, to create monochrome or polychrome ceramics. They mixed their engobes or inks in paint pots made of halved conch shells, which appear in carved and painted images. For the base engobe, they may have dipped the vessels into a vat or applied the engobe with cloth or leather. For detailed painting of images and texts, Maya artists used different kinds of brushes. One, sometimes called a brush pen, consisted of a hollow tube made of reed or bamboo with attached hair bristles.[16] Another resembled a rigid stylus, and another had "a stiff shaft and a flaccid but pointed end, recalling the brushes used by modern Hopi pottery painters...made from looped fibers of the yucca plant."[17] Painters also appear to have used quill pens (*chehb*) for writing and painting in codices as well as on ceramics.[18]

While some of the circumstances of ceramic production remain unclear, archaeologists have found spaces in Maya buildings where artists engaged in artistic production. Artists' tools found in Structure M8-10 at Aguateca, Guatemala, for instance, included halved shells for paint pots and mortars, pestles for pigment preparation, a bark beater, polished stone axes, and other lithic tools made of obsidian and chert. These tools indicate that painting occurred in this structure, and additional evidence locates shell-ornament and textile production in the same space, thus revealing that multiple artistic media were crafted in this structure.[19]

15 See, for instance, the following LACMA works: M.2006.22, M.2009.93, M.2010.115.257, and M.2010.115.480.

16 Reents-Budet, *Painting the Maya Universe*, 36–41, 210; Michael D. Coe and Justin Kerr, *The Art of the Maya Scribe* (New York: Harry N. Abrams, 1998), 146.

17 Ibid., 38–41.

18 Coe and Kerr, *The Art of the Maya Scribe*, 148.

19 Takeshi Inomata, "The Power and Ideology of Artistic Creation: Elite Craft Specialists in Classic Maya Society," *Current Anthropology* 42, no. 3 (June 2001): 326–28.

Wherever they practiced their craft, artists applied engobe in different ways to create complex polychrome designs. Direct application was the most common technique, in which artisans painted images much as one might on paper. Artists also employed resist-painting techniques, first applying an undercoat and then using wax or resin to block out areas around which they painted with other colors. During the firing, the resinous material burned off, leaving the earlier painted layer visible.

Regardless of the decorating technique used, artists often burnished the vessels by using a pebble, gourd, piece of leather, or other material to compact the clay and polish the surface. These decorating and finishing techniques are not visible in radiographs and only become apparent through visual and tactile examination of a vessel's surface.

Firing

After the ceramic artist or artists completed the vessel, they planned for the firing. The vessel must dry sufficiently before firing; otherwise, it may break or explode. Classic-period Maya ceramics fall into the category of low-fire pottery, with firing temperatures within a range of 900 to 1260 degrees Fahrenheit (approximately 500 to 700 degrees Celsius).[20] Indeed, details regarding the methods with which the Classic-period Maya fired their ceramics remain unclear.[21] Researchers can make some assumptions from studies of ceramics: the discovery of wasters, or vessels damaged during production and subsequently abandoned; and cross-cultural as well as ethnographic comparisons.[22]

Open bonfires, in which fuel and ware are intermingled and burned above ground, and pit firing, in which fuel and ware are intermingled in a pit or trench dug into the ground, constitute two possible methods.[23] Determining the sites of such firing presents inherent difficulties. Bonfire kilns observed ethnographically in Oaxaca and elsewhere leave meager or few definitive traces that archaeologists could identify.[24] Traces one would expect include indications of heated ground and the presence of ash as well as ceramic processing material.[25] The limited evidence for firing areas in the Classic Maya lowlands may simply be the result of the difficulty of finding or identifying such traces.

Regardless of whether the pots were fired in pits or bonfires, additional questions remain regarding the firing of fine polychrome vessels. Maya potters may have relied on saggers (boxes or containers of fired clay that hold other vessels during firing) to protect pottery through the process, although archaeologists have yet to find any such containers.[26] On many fine polychrome vessels, the absence of fire clouds—surface discolorations resulting from direct contact with burning fuel—suggests that potters protected them, perhaps with saggers, during firing.

20 Reents-Budet, *Painting the Maya Universe*, 214.

21 Rice, *Pottery Analysis*, 27; Marshall Becker, "A Classic-Period Barrio Producing Fine Polychrome Ceramics at Tikal, Guatemala: Notes on Ancient Maya Firing Technology," *Ancient Mesoamerica* 14, no. 1 (July 2003): 95–112, https://doi.org/10.1017/S0956536103141053.

22 Barbara L. Stark, "Archaeological Identification of Pottery Production Locations: Ethnoarchaeological and Archaeological Data in Mesoamerica," in *Decoding Prehistoric Ceramics*, ed. Ben A. Nelson (Carbondale: Southern Illinois University Press, 1985), 158–94; Christina T. Halperin and Antonia E. Foias, "Pottery Politics : Late Classic Maya Palace Production at Motul de San José, Petén, Guatemala," *Journal of Anthropological Archaeology* 29, no. 3 (September 2010): 392–411.

23 Becker, "A Classic-Period Barrio," 96; Rice, *Pottery Analysis*, 172.

24 W. David Kingery, "Operational Practices of Ceramic Kilns," in *The Prehistory and History of Ceramic Kilns*, ed. Prudence M. Rice (Westerville, OH: American Ceramic Society, 1997), 13; Gary M. Feinman and Andrew Balkansky, "Ceramic Firing in Ancient and Modern Oaxaca," in Rice, *Prehistory and History*, 131, 133.

25 Kingery, "Operational Practices of Ceramic Kilns," 13.

26 Becker, "A Classic-Period Barrio," 96–97, 103, 106; Rice, "Maya Pottery Techniques and Technology," in *Ancient Technology to Modern Science*, ed. W. David Kingery (Columbus, OH: American Ceramic Society, 1985), 118; Rice, "Late Classic Maya Pottery Production: Review and Synthesis," *Journal of Archaeological Method and Theory* 16, no. 2 (2009): 121.

Although potters may well obliterate most traces of their work, many traces remain. Indeed, this project's studies of radiographs in tandem with close visual and tactile analysis revealed abundant information about the making of the vessels in this study. This information is inevitably limited but can be expanded by incorporating knowledge gained from several important sources: wisdom conveyed by modern and contemporary Maya potters about their materials and manufacturing processes through ethnographic studies, information from the archaeological record and the study of sherds about specific materials used in Classic Maya pottery production, and insight from the practice of handling clay and making pottery. Together, these diverse and complementary sources of knowledge allow the reconstruction of a possible operational sequence for the Classic-period Maya crafting of fine polychrome ceramic vessels.

Fig. 11
Composite photograph and radiograph of "The Perfect Pot" (cat. 18)

5 Transformation through Fire: The Art of Ceramic Painting

Diana Magaloni, John W. Hirx, Laura Maccarelli, and Charlotte Eng

The art of painting with colored clays ranks among the most important achievements of ancient Maya artists. These ceramic paints acquire their various colors through the process of firing, requiring the ceramicist to envision the transformative properties of clays and minerals before painting. Once fired, colored clays become solid paint layers with the same properties as the ceramic body, making them resistant to deterioration. Ceramic paints fall into two categories: those designed and manufactured by artists, called engobes; and those occurring naturally, known as slips.[1] With the aid of technical imaging and noninvasive and micro-invasive techniques, including portable x-ray fluorescence (pXRF), fiber optic reflectance (FORS), Fourier transform infrared (FT-IR), and Raman spectroscopies, as well as x-ray diffraction (XRD) analysis,[2] LACMA's Maya Vase Research Project investigated the chemical composition of the ceramic paints on twenty-five vessels in the museum's collection, a process that revealed new insight into the aesthetic choices of Maya ceramic artists.

Perhaps armed with expectations regarding the behaviors of paints based on experience with, and knowledge of, those used for painting and writing over lime-stucco substrates in mural and manuscript painting (which do not require firing), Maya potters sought to engineer, for all intents and purposes, their engobes. This level of engagement with ceramic paints implies a long tradition of experimentation and learning.[3] First, engobes need to be formulated to match the thermal expansion of the ceramic body, and small changes in the percentage of minerals and clays alter their thermal behavior, creating microbubbles or crackles upon firing. Distinct values or gradients of light and dark, saturation or intensity, result from specific mixtures of color-giving minerals, clays, melting agents, and color stabilizers, further influenced by firing temperature and atmosphere.[4] In sum, Maya ceramic artists had to manipulate their ceramic paints to control for transformative processes before and after firing, managing key properties such as color, rheologic behavior (or flow), opacity, thickness of application, covering power, and fusibility.[5] Thus, the challenges for the ceramicist not only entailed the composition, symbolism, and content of representations but also encompassed considerations comparable to those of a material scientist, including the need to understand the nature of raw materials and transform this knowledge into specific techniques. Present-day Indigenous ceramic artists from the southwestern United States, however, view these processes of transformation not as science but as belonging to a sacred knowledge that honors Mother Earth.[6] One can imagine that traditional Maya ceramicists similarly regarded their efforts to understand materials and their transformations as a spiritual pursuit that celebrated their relationship with the natural world and its metamorphoses.[7] Their success in the development of these colored clay paints constitutes the paramount contribution of Maya potters to global ceramic practices. The following hypotheses derive from visual examination, scientific analyses, and firsthand experience working and experimenting with ceramic materials.

Creating a Palette of Ceramic Paints

Maya painted ceramics make use of a palette with remarkable breadth that derives from four clay parent colors: red, yellow/orange, white, and black. Artists manipulated colored clays to achieve matte and saturated or translucent and glossy paint layers. They keenly developed lighter values, or tints, of each clay color by adding whitening agents such as calcium carbonate (lime) and calcium sulfate (gypsum). They also affected optical modifications of black pigments by mixing them with white clay and whiteners in various proportions to produce a gray-green or gray-blue tone.

1
This definition of ceramic paints derives from our hypothesis that these colors were developed by transforming naturally occurring materials into engineered engobes. The most notable characteristics of such paints include opacity, thinness, and covering power. Other authors have referred to these ceramic paints as "slips" and "*terra sigillata*." We want to emphasize that Maya ceramicists and painters would have had to alter natural clays with knowledge and experience.

2
For more on the scientific analytical methods employed by this study, see Laura Maccarelli and Charlotte Eng, "Scientific Methods of Analysis," in this volume.

3
For more on Maya pottery painters and artists, see Doree Reents-Budet et al., *Painting the Maya Universe: Royal Ceramics of the Classic Period*, exh. cat. (Durham, NC: Duke University Press in association with Duke University Museum of Art, 1994), 36–59.

4
The sensitivity of Maya ceramicists to color plays a fundamental role in understanding their artistic contribution, because Maya artists experimented with shifts in the value and saturation of their ceramic paints to alter optical qualities. Bryan R. Just, *Dancing into Dreams: Maya Vase Painting of the Ik' Kingdom*, exh. cat. (Princeton, NJ: Princeton University Art Museum; New Haven, CT: Yale University Press, 2012), 136.

5
Rheology, a branch of physics, studies properties of fluidity, which can be chemically manipulated. Fusibility refers to the ability of the ceramic paint to bond to the clay body of the vessel. Frank Hamer and Janet Hamer, *The Potter's Dictionary of Materials and Techniques* (London: A & C Black, 1997).

Technical analysis of works in this book's study set revealed that, to produce shades of red, orange, and yellow, Maya artists relied on iron-bearing minerals. Those most commonly used include hematite (Fe_2O_3), which is a deep, dark red; limonite ($FeO(OH) \cdot nH_2O$), which exhibits a mustard color; goethite (α-FeO(OH)), which appears orange; and rutile (TiO_2), characterized by yellow, orange, and red hues. The Yucatec Mayan language refers to all red, orange, and yellow ceramic paints as *kankab lu'um*, which means "yellow or red earth." Pockets of this red earth occur in the Yucatan Peninsula, and Maya potters still exploit these ores today.[8] Achieving and maintaining a precise color with raw oxides poses significant challenges, in part, because these ores can shift their color, in terms of both value and hue, upon firing.[9] All of the various tints and shades of red, orange, and yellow present in Maya ceramics would have been fired in a well-ventilated, oxidizing environment. The color of iron oxides in pottery is strongly influenced by the firing atmosphere. When completely oxidized, iron oxide appears red; when reduced (lacking oxygen), it becomes black. However, iron oxides can also shift hues drastically—yellow ores may turn orange or red. Experiments with clays containing iron prepared as engobes in LACMA's laboratories showed that the hue of iron-based colors upon firing can be predetermined by establishing a range of temperature. The precise coloring of Maya vessels thus demonstrates a well-established set of firing procedures.

The present study identified two distinct black engobes. The most ubiquitously used is a manganese-based engobe, likely manganese dioxide (MnO_2).[10] Near-infrared false-color (FCIR) imaging makes it easy to visually identify manganese-based engobes because they reflect a reddish-brown color (fig. 1). The Yucatec Maya word for this black ceramic paint, *tacoc*, means "excrement of the turtle," and present-day potters still produce it by collecting the small, round concretions of its source material deposited in swampy areas.[11] The ancient Maya used manganese engobe to paint the outlines of figures and forms, as well as to color clothing and the backgrounds of vases. The other black engobe contains a mixture of white clay, the pigment lamp black (carbon collected from fire), and variable proportions of a whitening agent.[12] This second black mixture acquires a greenish- or bluish-gray tone after firing. Because of this tonality, Maya artists used this engobe in representations of the green quetzal feathers of headdresses, jade pendants and bracelets, and other precious materials (see cats. 6 and 17).

XRD analysis identified one of the white clays used in the vases as belonging to the family of montmorillonites.[13] A similar kind of clay is still in use by the Yucatecan potters of Ticul, Mexico.[14] Among the vessels in this book's study set, calcium carbonate (lime) ranks as the most frequently used whitening agent. Maya ceramicists preferred white engobe as a primer to prepare a vessel's surface for painting. Just as in manuscript and wall painting, ceramic artists first applied a light ground upon which to create their compositions. If formulated correctly, the primer helps bond the colored engobes to the clay body, serving as a ceramic bridge. LACMA researchers hypothesized that the primer could contain potassium salts, which would act as fluxes to facilitate bonding. In this manner, the subsequent colored engobes appear backlit and luminous. Artists would sometimes add a second layer of white engobe to color the background of the painted design (see cat. 18), particularly on codex-style vessels (see cats. 1–5). White clays and whiteners also served as an important component of postfire polychromy, or surface decoration applied to an object after firing. Through pXRF spectroscopy, the study identified the use of calcium sulfate (gypsum) as a white postfire paint in the earrings of the principal personages on a

6
Brian Vallo, personal communication, May 2018.

7
Susan Peterson, *The Living Tradition of Maria Martinez* (Tokyo: Kodansha International, 1977), 81.

8
Raymond H. Thompson, *Modern Yucatecan Maya Pottery Making* (Salt Lake City: Society for American Archaeology, 1958), 91–94.

9
Anna O. Shepard, *Ceramics for the Archaeologist* (Washington, D.C.: Carnegie Institution of Washington, 1956), 18, 33, 36–38.

10
See Shepard, *Ceramics for the Archaeologist*, 41, and Sarah Nunberg, in Just, *Dancing into Dreams*, 221–35.

11
Thompson, *Modern Yucatecan Maya Pottery Making*, 94–95.

12
The presence of carbon black was suggested because in the black areas no other element characteristic of other black pigments was present; further analysis (such as Raman spectroscopy or XRD) would be necessary to confirm its presence.

13
XRD analysis confirmed the presence of montmorillonite in the ground layer of engobe on a shard at New York's Metropolitan Museum of Art; Federico Carò, personal communication, 2018.

14
Samples from the noteworthy clay deposits of Ticul confirm that the white clay deposits in the area, used continually from ancient to contemporary times, contain layered beds of kaolinite and montmorillonite, intermixed with limestone. Dean E. Arnold, *Maya Potters' Indigenous Knowledge: Cognition, Engagement, and Practice* (Boulder: University Press of Colorado, 2018), 80–85.

Fig. 1
Side-by-side comparison of the dynastic vase (cat. 2) in visible reflected light (left) and false-color infrared (right). Note the reddish appearance of the original black engobe in the FCIR, while the repainted glyphs remain black. The iron-rich pigments refract yellow.

cylinder vessel depicting a palace scene (fig. 2). Postfire painting on engobe-decorated Maya ceramics, however, more often occurs in bands of Maya blue at the bases and rims of vessels (see cat. 18). The invention of this extremely stable and beautiful pigment, manufactured by dying the white clay palygorskite (*sak lu'um*) with natural indigo, counts among the significant accomplishments of Maya ceramicists.[15]

Engobe Painting Sequence

In studying the painting methodologies of the selected vessels, researchers identified that the most widespread approach entailed painting from light to dark by applying layers of very thin engobes, one on top of the other. This approach begins with a primer coat of white engobe that homogenizes the surface and provides a luminous, light ground. In very few examples, this primer layer exhibits a buff-orange color. Maya artists always covered the white primer with subsequent layers of engobes, generally following a consistent sequence. First, they executed a preparatory drawing, outlining the figures and glyphs with thin black or red lines. The second step consisted of painting elements of the design with colored engobes. The third step usually involved retracing the drawing with a black outline. On one vessel, the painter also incised contour lines in some elements (cat. 20). The final step entailed painting the background with a flat, uniform color.[16] Artists sometimes inverted the order of the latter two steps, outlining the image after finishing the background.

15
Modern Maya potters from Ticul continue to use palygorskite (also known as attapulgite and sepiolite), though not as the basis to prepare Maya blue, but rather as an integral constituent of the fine temper (*nooy*) used to compose desirable clay bodies. Present-day Ticul potters, like the ancient Maya, refer to this clay as *sak lu'um* (white earth). Arnold, *Maya Potters' Indigenous Knowledge*, 43–49.

16
See Reents-Budet, *Painting the Maya Universe*, 210–11.

Fig. 2
Side-by-side comparison of vessel depicting a palace scene (cat. 6) in visible reflected light (left) and false-color infrared (right) showing the postfire application of white paint, gypsum, below the earflare, which has a greenish hue in FCIR. Note how the white headband and the eye, prefire-applied white engobe, remain white in FCIR.

Engobe Preparation

The choice of the right white clay fundamentally influences painting technique. Depending on their sources, one clay likely burned whiter than the other, one shrank more than the other, and they differed in their textures after firing. Once an artist established the clay base, the process of making the colored engobes included adding various concentrations of finely ground pigments or pigmented clays. Examination using pXRF spectroscopy identified iron, manganese, and calcium mixed with the clays. Additionally, along riverbeds, geologic sedimentary action can levigate clays, separating coarser elements and providing a source of naturally occurring slips of various colors.[17] Maya ceramicists likely used these as ceramic paints along with engineered engobes to achieve different aesthetic qualities.

Engobes and slips qualify as suspensions rather than solutions—they contain undissolved particles that can settle. The right percentages of clay particles, which take the shape of flat platelets with opposing electric charges in their faces and edges (fig. 3), help maintain the density and fluidity of ceramic paints.[18] Because of their charges and flat shape, clay particles tend to floc, aggregating into small lumps. Maya ceramic artists learned how to manipulate the degree of fluidity and density of their engobes as well as their transparency or opacity. In modern ceramic making, alkaline substances serve to deflocculate (separate) clays. The identification by pXRF spectroscopy of elements such as potassium and calcium in the engobes suggests that Maya artists probably used alkaline deflocculating substances. Based on historic and ethnographic observations, Maya potters had access to several materials that could have served this purpose. One important candidate is the slimy, alkaline limewater resulting from the preparation of *nixtamal*—corn kernels soaked in a mixture of quicklime and water and hulled for grinding into masa (this technique is utilized by Maya ceramicists in present-day Uayma, Yucatan). Other candidates include the limewater (calcium hydroxide) used for stuccowork or lye (potassium hydroxide) made by dissolving wood ash in water.[19] Alkaline materials used as mordants to fix dyes to cotton provide further possibilities: These include alum, in the form of potassium alum or aluminum sulfate, and *tequesquite*, from the Nahuatl word *tequixquitl*, a naturally occurring salt containing compounds of sodium chloride, sodium carbonate, and sodium sulfate.[20] Maya ceramic painters could have reused the liquids resulting from all of these processes; they would have worked perfectly well as deflocculants and fluxes due not only to their alkalinity but also their slimy consistency, which would have helped develop stable suspensions of powdered mineral pigments and clay particles. Clay workers execute the deflocculating process as a visual and physical experience, watching and feeling the viscosity change. The addition of an alkaline solution to the clays would further facilitate the process of finding an ideal balance of fluidity, because floccing results from insufficient or excessive deflocculant alike.

The use of an alkaline deflocculant affects the properties of ceramic paints in other significant ways: First, it decreases the amount of water needed in the engobe, allowing for the production of concentrated paints. This explains the high covering power of Maya engobes despite their thin application. Second, adding positively

17 Shepard, *Ceramics for the Archaeologist*, 31–43; Susan Peterson, *The Craft and Art of Clay* (Englewood Cliffs, NJ: Prentice Hall, 1992), 106, cited in Reents-Budet, *Painting the Maya Universe*, 231.

18 For comparable analysis of the properties of paints used in murals, see Paolo Mora, Laura Mora, and Paul Philippot, *Conservation of Wall Paintings* (London: Butterworths, 1984).

19 See Laura Maccarelli et al., "Postfire Painting," in this volume.

20 Tatiana Falcón, "Tintes de otoño: Experimentación con plantas tintóreas para la reinterpretación de los saberes, tradiciones y usos del color en manuscritos indígenas" (master's thesis, Universidad Nacional Autónoma de México, 2014), 50.

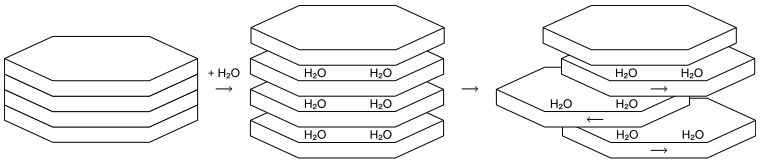


Fig. 3
The plasticity of clay derives from the structure and shape of its constituent platelets. When these interact with water, they slide with one another but do not separate. *Conservation of Wall Paintings* fig 3.3. (Redrawn by Louise Cameron-Coats after Paolo and Laura Mora and Paul Philippot.)

charged ions (cations) of sodium, potassium, and calcium to the clay lowers its melting point, enabling the ceramic paint to fuse and become vitreous, or glassy, as seen in the orange engobe of the vessel nicknamed "The Perfect Pot" by study participants (fig. 4; see also cat. 18). The glassy appearance of this orange engobe suggests a high concentration of such fluxes and silica.[21] Sodium, calcium, and potassium also help lower the viscosity of the clays, allowing paints to flow like ink.[22] Maya artists keenly took advantage of the various optical qualities of their engobes and slips. Clay paints that form translucent, glassy surfaces after firing create vivid colors, much like a glaze. Opaque engobes, on the other hand, produce flat, matte surfaces. Low concentrations of flux and the addition of whitening modifiers can create such refractory clay paints—less flux leads to higher melting points and thus reduced fusibility, allowing these paints to remain matte at the same temperatures that provide a glassy finish to translucent engobes. Before firing, Maya artists sometimes burnished both types of ceramic paint—perhaps with a piece of leather, wood, soft stone, or bone—once they had dried to a leathery state. After firing, these polished surfaces acquired a beautiful luster, whether translucent or opaque (fig. 5).

Two Aesthetic Pursuits

Through the manipulation and combination of the optical qualities of opaque and translucent engobes, Maya artists devised coloring strategies with distinct effects, which fall into two loose groups.[23] The first strategy strives to create what this study refers to as "pictorial environments," which portray a space beyond the setting of the vessel—for instance, the schematics of a temple or a room inside a palace. In these depictions, the use of color helps create a sense of place. The vessel becomes a medium for the image, a holder of a painting. The second coloring strategy emphasizes the ceramic object itself, and highlights the ceramic processes of painting and burnishing in such a way that the image, through the materiality of color, constitutes an index of the ceramic craft. Vessels decorated in this manner show sacred or secular motifs in an abstract fashion, often against a background of a single color. Artists sometimes combined both coloring strategies in one vessel, but, generally speaking, wares that re-create a pictorial environment tend to use opaque engobes and an expanded palette, while vessels emphasizing the materiality of clay as part of their aesthetic tend to use translucent ceramic paints with vivid colors in a comparatively reduced palette.

Pictorial Environments

Pictorial environments can include naturalistic representations, in which the use of tints or shades of color imitate the appearance of objects in the natural world, or imaginary scenes, as in depictions of the mythic space and time of creation and the gods. One vessel in LACMA's collection provides an exceptional example of naturalistic coloring technique (fig 6; see also cat. 6). It portrays a palace scene in which an artist, identified by his name and a paintbrush in his turban, visits a Maya ruler and offers him a sacred bundle of flowers.[24] A rollout photograph of the vessel displays the extent to which the artist strove to create paints of many hues and values that work together, creating a scene that appears almost as colorful and realistic as Maya murals of the Classic period (250–900 CE). The formulation of this and similar ceramic paintings effected a simultaneously luminous, matte, and saturated appearance—a significant ceramic achievement.

21 The addition of fluxes can also have tremendous color ramifications. For example, celadon glazes in Chinese high-temperature ceramics vary in color from green to blue just by changing the feldspars used as flux: A sodium feldspar yields a green glaze, while the same recipe with a calcium feldspar produces a blue glaze under the same firing conditions.

22 Hamer and Hamer, *Potter's Dictionary*, 352.

23 The coloring strategies described here present a method of closely observing the ceramic painting that seeks to encourage viewers to relate to these objects. They by no means seek to denote painting styles, which represent localized and regional traditions among the Classic Maya. For more on Classic Maya painting styles, see Reents-Budet, *Painting the Maya Universe*.

24 Reents-Budet, *Painting the Maya Universe*, 50–51.

Scientific analysis and technical imaging combined aided in the interpretation of the methods through which this artist created and applied these engobes. The cream-colored background mainly contains aluminum, silicon, and calcium. The artist first applied this white primer to cover all of the vase's surfaces, leaving bare only the exterior bottom. The deep red, used to paint the skin of the ruler and the standing figure, and the pink, applied to the throne and the feathers in the headdresses, seem to be made with different preparations of the same iron-based engobe.[25] The red paint, while heavily saturated, retains more translucence than the opaque pink. Analysis through pXRF spectroscopy suggested that the pink consists of a mixture of the red engobe and a whitener that contains calcium. With the bright orange engobe, the artist created even more variations. The painter used a saturated version on the *olla* vessel containing cacao near the center of the rollout, diluting the same pigment to color the three tamales on the plate in the lower right and the jaguar-pelt draperies in the upper corners. In the light orange of the standing figure's skirt and the lighter of the two skin tones, pXRF detected the same elemental composition as that of the bright orange engobe, tinted with a calcium-based whitener to lighten the value and increase the paint's opacity.

The artist explored yet another way of applying this orange paint to create textures. Tiny dots of this engobe form immaterial clouds of color in the white pillow at the ruler's back. They contain such low concentrations of pigment that they almost disappear in the FCIR image. The painter also used this method to apply black clouds of color, visible in both rollouts, to the arm, chest, thigh, and foot sole of the depicted artist. The same engobe, identified with pXRF as a manganese-based black, occurs in the contour lines of the figures and the black bands along the vessel's base and rim. This manganese pigment exhibits its telltale reddish hue in the FCIR image, making it easy to differentiate from other black engobes.

Another black engobe on this vessel acquires a greenish hue in the FCIR image. Analysis with pXRF found no manganese in this paint, only clay—a result consistent with the presence of carbon particles characteristic of lamp-black pigments. The artist used this carbon-black engobe to achieve the gray-green tone of the long quetzal

25 pXRF can only identify elements, in this case, iron (Fe); to distinguish between minerals, researchers use XRD analysis and/or Raman spectroscopy, which identifies the unique crystalline structure of the pigment. In this case, because of the dark red color, we can infer that the mineral is hematite.

Fig. 4
Detail of cat. 18 showing the glassy surface of the orange engobe, probably prepared with sodium or potassium salts as flux

Fig. 5
Detail of cat. 6 showing the matte surface of the skin tone and the pink throne; both engobes were formulated using calcium carbonate as a whitener

Fig. 6
Rollout photographs in visible reflected light and FCIR of cat. 6

feathers in the headdresses, the jewelry worn by the three personages (pendants, beads, and bracelets), the flanking columns, and the cacao pods in the orange *olla*. The same pigment appears black in the waist plaques worn by the ruler and the standing figure. Examination of these green-hued black and gray paints under higher magnification with a digital microscope revealed that these colors consist of a combination of a white matrix (montmorillonite) and tiny black carbon particles. The artist conceived of these mixtures in order to imitate the deep, dark green color of jade and the shimmering blue-green color of the quetzal feathers, both indexes of preciousness and wealth. At the time of this vessel's creation (c. 500–900 CE), Maya artists had mastered the production of the pigment Maya blue. Contrary to a commonly held

idea, the present gray-green engobe does not derive from the alteration of an originally bright-green paint or of Maya blue.[26] Instead, the lamp-black pigment dispersed in the white clay exhibits dichroic properties, simultaneously absorbing light to appear black while reflecting some green. The vessel makes use of two shades of white besides that of the background. The translucent white used to create small details in the faces and the ear ornaments as well as to paint the feather shafts is calcium sulfate (see fig. 2).

A second example of this coloring strategy appears on the *Vase of the Eleven Gods* (see fig 12, see also cat. 10). This pictorial environment, however, creates a radically alternate reality. With a reduced palette of colors—black, white, and red—the artist depicted a mythic scene of a place beyond in which the gods witnessed the dawn of time and creation. The format of the vase also differs from the previous example. This squared vessel alternates background colors of red and black on each side (fig. 7). These colors, applied in a saturated fashion, symbolize the black and red place of creation of Mesoamerican myth.[27] Because of the extent of the vessel's restoration and repainting, the project chose to forgo pXRF analysis. However, technical imaging and digital micrographs played an important role in establishing the manner in which the painter proceeded, and FCIR imaging helped to determine the likely nature of the pigments.

Looking at the pot from above, one can see the white primer on the upper rim (see fig. 8). The artist left the interior (as well as the bottom) of the vase unpainted, underscoring the importance of the painted flat surfaces as image holders. Close examination with a stereomicroscope enabled the reconstruction of the procedures and steps followed by the artist in creating these painting layers. After burnishing the surface of the dried white engobe, the artist drew the figures with black, detailing various elements with a fine brush in a manner that suggests a draftsman trained in calligraphy. Importantly, the apparent emphasis on the rhythm of the lines foregrounds the drawing process—the process of creation. These spontaneous and fluid lines create figures imbued with energy and movement even though they appear seated and in profile (see fig. 7).

In the second step, the painter added color in an impressionistic fashion, enhancing the vibrancy of the scene. In the images with black backgrounds, a diluted red engobe accentuates specific elements of the composition (fig. 9). The artist

26 Reents-Budet hypothesized that the gray used to color feathers and jade might have been originally green, and that it decomposed through the firing process: *Painting the Maya Universe*, 214.

27 In Central Mexico, the black and red realm of creation was called Tillan Tlapallan, and Quetzalcoatl, the plumed-serpent deity of Mesoamerican culture, traveled there in his death.

Fig. 7
Detail highlighting the calligraphic, energetic line of the drawing

Fig. 8
View from above showing the white primer on the rim of the vessel

Fig. 9
Detail highlighting the watercolor-like wash of red engobe and the careful white detailing, reminiscent of the Maya manuscript-painting tradition

painted this engobe over the black lines of the drawing in an unconstrained fashion, much like washes of watercolor. In contrast, the decoration also makes use of another engobe, applied in a more precise manner. The cotton garments of the figures present as a bright, opaque white, which the artist applied carefully, respecting the contour lines of the drawing; here, the black detailing occurs on top of the white engobe. The micrograph also reveals that the last step entailed applying the black paint of the background; the brushstrokes stop just before the contours of the figures, creating the illusion of a white outline (fig. 10).

The artist seems to have followed a similar process on the surfaces with red backgrounds, this time using diluted black to paint the bodies of the gods (see fig. 7). The strokes are careful enough to leave a white line around the contours of the arms and in the chest, creating a secondary outline. A diluted orange engobe, lighter than the red of the background, decorates the attire and other ritual elements, such as the furniture on which the figures sit. The artist applied this pigmented engobe after the black line drawings. The white color decorating the garments and other areas stands out in this image. The detail shows both layers of white clay: the primer and the white ceramic paint (lighter) used to decorate the garments; that is, the artists used the white engobe as both a pigment to paint on top of the light primer, but also took advantage of the color of the primer in creating the composition, a painterly resource also seen in mural painting.

The flat, saturated backgrounds constitute an important and technically challenging aesthetic pursuit. The black engobe used on this vase displays the signature reddish reflection of manganese-based minerals in FCIR images. The micrograph shows that this black surface cracked, illustrating the complexity of working with ceramic paints (fig. 11). The crackles could have resulted from differences in the thermal behavior of the white engobe ground and that of the thick layers of manganese paint applied on top. The decision to tackle such challenging design elements, however, may belie the significance of their symbolic and aesthetic functions.

Both backgrounds create a contrasting effect with the figures (fig. 12). The artist populated the saturated and flat atmosphere of the backgrounds with deities painted in an impressionistic fashion. Use of a watery engobe allows the strokes, and thus the painting procedure, to remain visible, foregrounding the creation of the painted figures as well as the context of mythic creation in which they appear.

Fig. 10
Micrograph of cat. 10 showing the sequence of painting layers. Note the original drawing of the teeth over a white base surrounded by black engobe applied as the last layer in the process. (Micrograph by Charlotte Eng and Laura Maccarelli.)

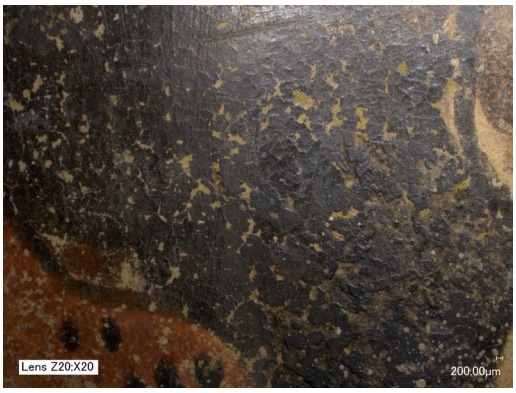


Fig. 11
Micrograph of cat. 10 showing the crackled black engobe (micrograph by Charlotte Eng and Laura Maccarelli)

Fig. 12
View of two sides of the *Vase of the Eleven Gods* (cat. 10)

The energetic figures are thus imbued with the stream of creation. In this manner, the red and black backgrounds create a unique pictorial environment—the formless alternate space and time of creation from which the gods emerge. This ceramic artist controlled the medium perfectly; where the design called for precision, the artist painted fastidiously—for instance, in evoking the false white outlines of the figures. Where the design required energy and movement, the artist acted as a fast, intuitive draftsman. The place beyond and the moment of creation thus take shape through the juxtaposition of two distinct approaches to managing colored engobes: the flat and homogeneous opaque backgrounds and the vibrant lines and translucent colors of the figures.

Painting as an Index of the Ceramic Craft

In decorating two of the vessels in this book's study set (cats. 19 and 22), the artists left visible the processes of painting and burnishing, creating a much more translucent, ceramic-like surface in comparison to that of the *Vase of the Eleven Gods* (cat. 10) and the vase with the palace scene mentioned above (cat. 6). The coloring strategy in the present vessels seems to rely on the material and optical characteristics of clay—that is, colors do not imitate the saturated and homogeneous surfaces of traditional painting but rather emphasize the texture of the clay particles, which pool in some areas while dispersing and appearing translucent in others. In this regard, the coloring technique references a distinctly ceramic aesthetic, differentiating itself from mural or manuscript painting. The palette of the black-background cylindrical vase (cat. 22) consists of three paints: a black with a brown hue, a cream, and a red (fig. 13). Close observation shows that the cream-colored areas of the central motifs, which depict two Water-Lily Serpents, make use of the same ceramic paint that served as the ground layer. This cream-colored paint does not cover the bottom of the vessel or its interior. The painter then skillfully drafted the figures with a brush in black outlines, finishing them with two widths of lines: a tenuous line to detail the inner parts of the figures and a darker, sharper one that serves as the contour. The artist applied red to emphasize certain elements, painting on top of the black contour and details, sometimes even covering them in a manner that recalls that used on the *Vase of the Eleven Gods*. Finally, the artist added the background color using a manganese-based black engobe, which the study identified through pXRF spectroscopy. Although the black backgrounds of the *Vase of the Eleven Gods* contain the same pigment, the procedures used on the present vessel differ significantly. Comparison of the technical images enable observers to discern not only the width of the brush and the movements of the strokes as the artist covered the surface but also the process of burnishing. While the painter of the *Vase of the Eleven Gods* disguised the ceramic surface with flat, homogeneous fields to re-create a pictorial environment, this artist proudly showcased the ceramic essence of the vessel.

Further examples make use of a similar color scheme but create drastically different effects: a Naranjo-style vessel from Xultun, Guatemala, which depicts the dance of the Maize God (cat. 21), and an outstanding cylinder vessel with a pedestal base, nicknamed "The Perfect Pot" (cat. 18). As with the majority of Maya painted ceramics, the artist of the Perfect Pot first prepared the surface with a white clay primer. In this case, the painter left the bottom and the inside of the vessel bare (fig. 14). Over the smoothed white primer, the artist drafted figures with light orange lines, then filled in the color with a translucent, glossy red-orange engobe,

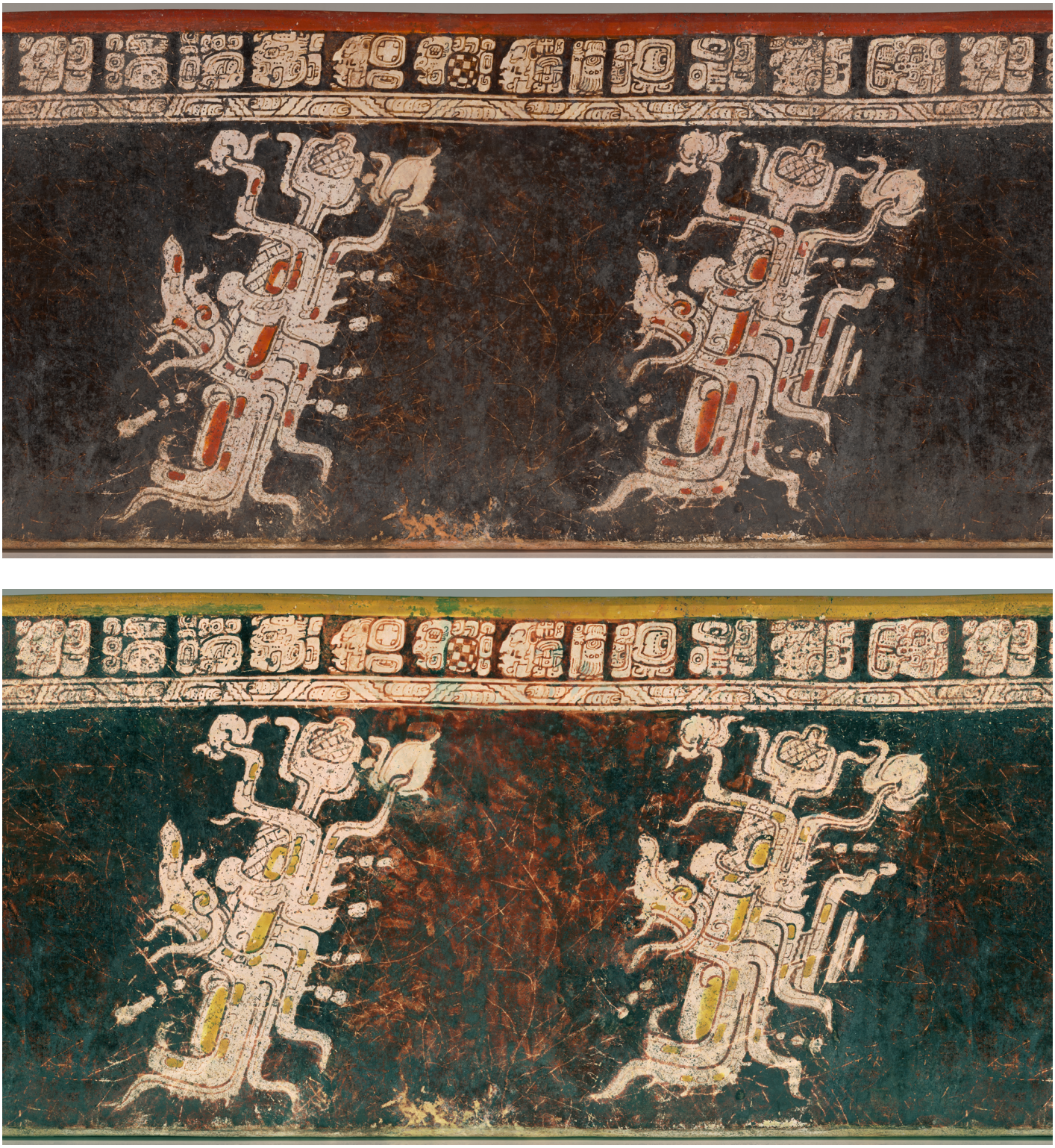


Fig. 13
Rollout photography in visible reflected light (top) and FCIR (bottom) of cat. 22

leaving no distinct outline. As the final step before firing, the painter applied a second layer of white engobe to color the background. This second white ceramic paint has detached in some areas, revealing the white ground layer (fig. 15). Using pXRF, researchers identified chlorine in the white engobe, suggesting the probable presence of a salt that caused the paint to spall, or delaminate. The red-orange motifs, however, did not spall. Hypothetically, the flux that gave this red-orange paint its glassy finish could have migrated into the underlying white engobes, causing them to fuse (see Studies of Manufacturing Techniques of cat. 18).

The glassy sheen of the motifs contrasts with the matte-white background. The artist intentionally created paints with different optical qualities to enhance the aesthetic beauty of the vessel. The application of the red-orange paint purposefully takes advantage of the clay particles that pool and disperse, highlighting an underlying aesthetic rooted in the characteristics of ceramics. FCIR imaging makes it possible to trace the movement of the brush as it executed the design, increasing and decreasing the concentration of paint. The glyphs around the upper rim bear the same translucent red-orange ceramic paint, but the artist emphasized their contours with a darker red engobe, subsequently cleaning the outlines with a stylus to create a sharp presentation. Lastly, the artist finished the vessel with the bright blue rim at the base using a postfire paint. This certainly constitutes an important symbolic addition: The pigment is Maya blue. This embellishment expands the significance of "The Perfect Pot." Along with the vase's refined formal and decorative elements, the presence of Maya blue indicates the precious nature of the vessel.

The vessels discussed above exemplify the two aesthetic strategies employed by Classic Maya ceramic painters. These artists created pictorial environments by manipulating ceramic paints to emulate the appearance of murals and, likely, manuscripts. They formulated matte, saturated, and extremely thin engobe layers to re-create in ceramics this painting aesthetic. Ceramicists also keenly created glossy, translucent engobes that underscore the ceramic characteristics of the paints, juxtaposing their optical qualities with those of opaque, matte surfaces. By emphasizing the materiality of clay, in both the vessel and its decoration, Maya ceramic artists created objects that collectively serve as an index of the ceramic craft. These technical accomplishments required years of experimentation, likely constituting a highly regarded skillset among the makers and consumers of ceramics alike.

Fig. 14
Views of rim and base of "The Perfect Pot" (cat. 18)

Fig. 15
Rollout photography in visible reflected light (top) and FCIR (bottom) of “The Perfect Pot” (cat. 18)

6 Postfire Painting

Laura Maccarelli, Megan E. O'Neil, Diana Magaloni,
and Charlotte Eng

After the firing process, Maya potters deemed some vessels complete. Engobe-painted ceramics, described in the previous essay in this volume, fell into this category. Others were decorated with postfire techniques. By painting postfire, artists could use pigments that would not survive the firing process, allowing them to attain a range of colors unachievable with low-fire engobe-painting technologies. In order to study the plasters and pigments painted postfire on ceramics, the LACMA collaborative team employed a variety of nondestructive and micro-destructive techniques. The results of this analysis show that Maya artists decorating ceramic vessels used materials and techniques similar to those of muralists.

Postfire painting on Maya ceramics and Maya painting of wall murals used lime plaster as their basis. To create lime plaster, limestone is quarried, cut up, and burned. Mixing the resulting powder, called quicklime, with water creates slaked lime.[1] Studies of Late Classic (600–800 CE) Maya murals as part of the project La Pintura Mural Prehispánica en México, of the Universidad Nacional Autónoma de México's Instituto de Investigaciones Estéticas in Mexico City, demonstrated that mural artists found an outstanding technical solution for slaking lime in water mixed with complex polysaccharides, which they obtained from the bark of certain trees.[2] The Maya mixed this slaked lime with fillers such as sands or crushed limestone, commonly using a local sand composed of calcium carbonate and silicon called *sah kab* in Yucatec Maya or *sascab* in Spanish and English.[3] This mixture creates plastic (in terms of malleability), light, and durable lime plasters.

Mural painters used ground mineral pigments such as malachite and ochers as well as carbon black. Diana Magaloni's studies of twenty-three sites with murals in the Maya lowlands showed that artists created paint suspensions using lime water and a polysaccharide, possibly extracted from orchids—a technique that likewise took advantage of the binding properties of lime.[4] Maya mural painters also mixed ground mineral pigments with clays. In addition, they used Maya blue, an artificial pigment that the Classic-period (250–900 CE) Maya invented by mixing and heating palygorskite clay with indigo dye.[5]

Maya artists applied similar pigments and plasters to ceramic vessels in a variety of ways. They sometimes painted vessels already decorated with polychrome engobe painting. In some cases, the painted stucco fully covered the earlier slip painting, as with a basal-flange vessel from a Holmul burial.[6] For others, the postfire paint covered only part of the vessel. One kind of postfire embellishment to polychrome ceramics entailed the addition of a band of stucco colored with Maya blue applied to the upper or lower rim (see, for instance, cats. 10, 18, and 24). Another type accentuated details of an engobe-painted image—for example, artists applied Maya blue to depictions of feathers and jewelry that in life were blue-green. Alternatively, on a cylinder vessel with a palace scene (cat. 6), the painter applied white gypsum postfire to add details to the feathers, jewelry, and faces of the ruler and attendants. In many other instances, postfire painting created the entire painted design (see cats. 12–16).

Early Classic Maya Teotihuacan-Style Stucco-Painted Vessels

Painted stucco appeared on Late Preclassic (300 BCE–250 CE) Maya ceramic vessels in the Peten, Guatemala—at Holmul, Uaxactun, and Tikal, for instance—and at Kaminaljuyu in the Guatemalan highlands.[7] However, in the fourth century CE, Maya artists began to make stucco-painted vessels in forms such as a tripod cylinder that were similar to those from Teotihuacan, in present-day Mexico (fig. 1). Teotihuacan

1 Paolo Mora, Laura Mora, and Paul Philippot, *Conservation of Wall Paintings* (London: Butterworths, 1984), 50.

2 As part of the Maya subdivision of the La Pintura Mural Prehispánica en México project, Diana Magaloni studied Late Classic lime plasters from mural paintings from twenty-three sites, and, subsequently, Eric Hansen and Heather Hurst made important contributions regarding works of the Middle Preclassic (900–300 BCE) and Late Preclassic (300 BCE–250 CE) periods, respectively. Magaloni, "El arte en el hacer: Técnica pictórica y color en las pinturas murales de Bonampak," in *La pintura mural prehispánica en México II: Área maya—Bonampak*, book 2, *Estudios*, ed. Beatriz de la Fuente and Leticia Staines Cicero (Mexico City: Instituto de Investigaciones Estéticas, Universidad Nacional Autónoma de México, 1998), 49–80; Magaloni, "Materiales y técnicas de la pintura mural Maya," in *La pintura mural prehispánica en México II: Área maya*, book 3, *Estudios*, ed. Staines Cicero (Mexico City: Instituto de Investigaciones Estéticas, Universidad Nacional Autónoma de México, 2001), 155–98; Hansen, "Ancient Maya Burnt-Lime Technology: Cultural Implications of Technological Styles" (PhD diss., University of California, Los Angeles, 2000); Hurst, "Murals and the Ancient Maya Artist: A Study of Art Production in the Guatemalan Lowlands" (PhD diss., Yale University, 2009).

3 Magaloni, "Materiales y técnicas"; Dean E. Arnold, *Maya Potters' Indigenous Knowledge: Cognition, Engagement, and Practice* (Boulder: University Press of Colorado, 2018), 73.

4 Magaloni, "Arte en el hacer"; Magaloni, "Materiales y técnicas."

artists had long applied painted stucco on older engobe-painted vessels—in some cases, years after their initial creation. But from the Early Xolalpan phase onward, c. 350, Teotihuacan potters began to texture the surface of the clay before firing vessels made specifically for stucco painting.[8] They likely perceived that stucco would better adhere to such textured surfaces. For the Classic-period Maya vessels in this book's study set, however, artists slipped and burnished the clay before firing, producing a smooth, highly polished surface onto which they applied the stucco (fig. 2). To date, the LACMA project has found no Maya examples with texturing comparable to that of contemporaneous vessels from Teotihuacan. Nonetheless, in the present examples, the stucco layer generally adheres well to the polished ceramic, suggesting that Maya artists trained to fabricate effective and enduring plasters.

Several Maya stucco-painted vessels in the LACMA collection dating to the late fourth or fifth centuries (cats. 12–15) share design elements with other Maya tripod cylinders from Tikal Burials 10 and 48 and Tombs 19 and 23 at Río Azul, Guatemala (fig. 3).[9] The vessels in the LACMA study set and those found at Tikal and Río Azul evoke Teotihuacan designs but are inflected by distinctive Maya adaptations. For instance, several include Maya texts labeling them as vessels for *kakaw* (chocolate). The painted inscription on one of the LACMA vessels identifies the owner as a *yajaw* (vassal) of Jatz'oom Kuy, also known in contemporary scholarship as "Spearthrower Owl," the name of a person—perhaps a leader—or an esteemed title from Teotihuacan (cat. 14).[10] The mention of a relationship with Jatz'oom Kuy aligns with the vessel's stylistic references to works produced in that city.

Visual examination of three of these Teotihuacan-style stuccoed vessels identified similar surface treatment and painting techniques (cats. 12–14). On all three vessels, the ceramic surfaces destined for stucco application were characteristically slipped and burnished before firing.[11] Additionally, the feet of the vases incorporate vertical firing holes on their exteriors, differing from the feet of vessels from Teotihuacan, which evoke architectural features such as *almenas* and *talud-tablero* architectural profiles. Furthermore, neutron activation analysis (NAA) shows that all three ceramic vessels share similar clay chemistry, although the composition of the Jatz'oom Kuy vessel differs slightly.[12] These shared formal, decorative, and compositional elements suggest a common origin.

5
R. Kleber, L. Masschelein-Kleiner, and J. Thissen, "Étude et identification du 'Bleu Maya,'" *Studies in Conservation* 12, no. 2 (May 1967): 41–56; G. Chiari et al., "Pre-Columbian Nano-technology: Reconciling the Mysteries of the Maya Blue Pigment," *Applied Physics A* 90 no. 1 (January 2008): 3–7, https://doi.org/10.1007/s00339-007-4287-z.

6
Virginia M. Fields and Dorie Reents-Budet, *Lords of Creation: The Origins of Sacred Maya Kingship*, exh. cat. (Los Angeles: Los Angeles County Museum of Art, 2005), 244.

7
Robert E. Smith, *Ceramic Sequence at Uaxactun, Guatemala*, 2 vols. (New Orleans: Middle American Research Institute, Tulane University, 1955), 59; T. Patrick Culbert, *The Ceramics of Tikal: Vessels from the Burials, Caches, and Problematical Deposits* (Philadelphia: University Museum, University of Pennsylvania, 1993), fig. 11b.

8
Cynthia Conides, "Social Relations Among Potters Teotihuacan," *Museum Anthropology* 21, no. 2 (September 1997): 47–48; Conides, "The Stuccoed and Painted Ceramics from Teotihuacan, Mexico: A Study of Authorship and Function of Works of Art from an Ancient Mesoamerican City" (PhD diss., Columbia University, 2001), 211; Jessica M. Fletcher, "Stuccoed Tripod Vessels from Teotihuacán: An Examination of Materials and Manufacture," *Journal of the American Institute for Conservation* 41, no. 2 (Summer 2002): 142; Evelyn C. Rattray, *Teotihuacan: Ceramics, Chronology, and Cultural Trends* (Mexico City: Instituto Nacional de Antropología e Historia; Pittsburgh: University of Pittsburgh, 2001), 119, 231; Megan O'Neil, "Stucco-Painted Vessels from Teotihuacan: Integration of Ceramic and Mural Traditions," in *Teotihuacan: City of Water, City of Fire*, ed. Matthew H. Robb, exh. cat. (San Francisco: Fine Arts Museums of San Francisco, 2017), 180–87.

9
For more on the ceramics interred in Tikal Burials 10 and 48 and consideration of their relations with Teotihuacan and Kaminaljuyu, see Clemency Chase Coggins, "Painting and Drawing Styles at Tikal: An Historical and Iconographic Reconstruction" (PhD diss., Harvard University, 1975). Dorie Reents-Budet, Ronald L. Bishop, and other collaborators used neutron activation analysis (NAA) to analyze these and other vessels from Tikal Burials 10 and 48 as well as Problematic Deposits 22 and 50 in order to determine which were locally made and which imported: Reents-Budet et. al, "Early Classic Ceramic Offerings at Copan: A Comparison of the Hunal, Margarita, and Sub-Jaguar Tombs," in *Understanding Early Classic Copan*, eds. Ellen E. Bell, Marcello A. Canuto, and Robert J. Sharer (Philadelphia: University of Pennsylvania Museum of Archaeology and Ethnology, 2004), 159–90.

10
Simon Martin, *Ancient Maya Politics: A Political Anthropology of the Classic Period, 150–900 CE* (Cambridge: Cambridge University Press, 2020), 242; David Stuart, "'The Arrival of Strangers': Teotihuacan and Tollan in Classic Maya History," in *Mesoamerica's Classic Heritage: From Teotihuacan to the Aztecs*, eds. Michael Carrasco, Lindsay Jones, and Scott Sessions (Boulder: University Press of Colorado, 2000), 481–89.

11
The lids' interiors and the vessel bottoms were neither slipped nor burnished; the vessels' interiors were slipped and burnished.

12
For more on NAA and its application in this study, see Reents-Budet and Bishop, "Pottery of the Central and Eastern Peten: A Study of Chemistry and Style," in this volume.

Fig. 1
Pair of Teotihuacan stucco-painted vessels, 450–500 CE, LACMA, gifts of Constance McCormick Fearing, AC1998.209.16.1–.2

Fig. 2
Details of the textured ceramic surface of one of the Teotihuacan vessels (top) and the smooth, burnished ceramic surface of a Maya vessel (bottom), LACMA, AC1998.209.16.1 and M.2010.115.1066b

Fig. 3
Teotihuacan-style stucco-painted ceramic tripod cylinder vessel, Burial 10, Tikal, Guatemala

To further explore the relationship between these stylistically and materially similar vessels, LACMA's study thus focused particularly on comparing their stuccoes and pigments to one another and to other Maya and Teotihuacan vessels in the LACMA collection.

The artist or artists who painted each of the Maya vessels first applied a white or cream plaster ground layer on the walls and lids of each of the three fired vessels. This characteristic not only mirrors the plaster ground layer applied to walls for Maya mural painting but also corresponds to the techniques used to create stuccoed vessels and murals at Teotihuacan. The artists then applied pigments in designs comprising a background and roundels on top of the ground layer. The artist or artists finished these vessels by applying calligraphic and painterly black lines on top of the other pigment layers. In contrast to ceramics made in Teotihuacan, which use sharp, incised outlines to define features, there are no incisions into the stucco or pigment layers on any of these vessels (fig. 4).

Analysis of cross sections of the stucco and pigment layers from each vessel under a polarized light microscope (PLM) and of images obtained through scanning electron microscopy with energy dispersive x-ray spectroscopy (SEM-EDS) shows calcium as the major component of each ground layer, confirming the use of a calcium-rich stucco (such as calcium carbonate or lime), and all contained some aluminum-silicate (clay) inclusions too.[13] A cross section from the green border of the Jatz'oom Kuy vessel shows that the lime-plaster matrix contains crushed limestone as fillers in a wide variety of sizes and shapes (fig. 5; see also cat. 14). The angular orientation of the acicular (or needle-shaped) particles in the upper

Fig. 4
Details of the final black lines on a Maya stucco-painted vessel, executed over orange and red (top), and those of a Teotihuacan vessel, incised into the stucco and filled with black paint (bottom), LACMA, M.2010.115.1067b and AC1998.209.15 (micrograph by Charlotte Eng and Laura Maccarelli, LACMA Conservation Center)

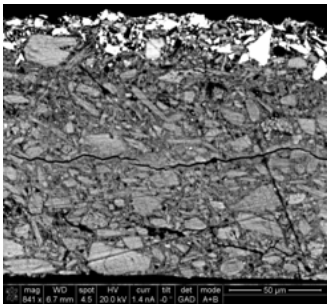
section likely resulted from the artist compacting or smoothing the plaster. SEM-EDS images of the cross section of the second of these tripod vessels show what appear to be two layers of plaster (fig. 6; see also cat. 13). The bottom layer contains inclusions of different shapes and sizes. Elongated or acicular inclusions, all oriented horizontally, occur in the upper layer, resembling the ground-layer structure in the Jatz'oom Kuy vase. In the third vessel in this group, the inclusions are more rounded compared to those in the other plasters (fig. 7; see also cat. 12). The preparation of Maya stuccoes by mixing lime with crushed limestone resembles the technique used in Teotihuacan. Investigation using other analytic tools (for instance, gas chromatography with a mass spectrometer) may further distinguish the possible use of a polysaccharide as an additive for producing such a plastic and durable lime paste, as in Maya murals.

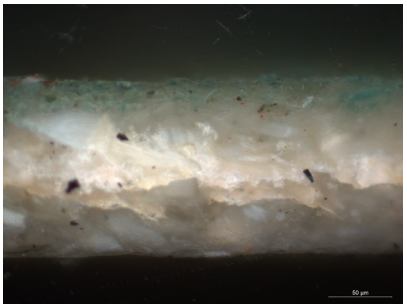
After the application of the stucco layer, the artists applied the pigments. Portable x-ray fluorescence (pXRF) spectroscopy and SEM-EDS allow close examination of the chemical content of these pigments. In the light blue-green background and borders on the Jatz'oom Kuy vessel, for instance, SEM-EDS elemental maps identify the paint layer as a composite of different elements, copper and phosphorus (fig. 5; see also cat. 14). This suggests the use of a copper-phosphate pigment (like pseudomalachite). Fiber optic reflectance spectroscopy (FORS) confirmed the use of a green pigment different from malachite. Concentrated silicon and aluminum in the top layer indicate that the pigment was mixed with an aluminum-silicate clay. Both fields of the diagonally split cartouches, painted red and orange, contain mixtures of cinnabar and an iron oxide. Although most of the colors occur side by side, the red appears to be painted on top of the orange.

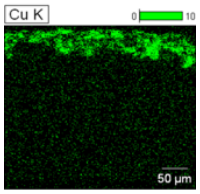
The pigments of the other two vessels (the one with the ancient repair and the one with Teotihuacan-style buildings) have similar chemical makeups, with some variations (cats. 12–13). On both vessels, artists applied a pink layer—an element absent on the Jatz'oom Kuy vessel—on top of the white ground layer. This pink layer contains iron, calcium, aluminum, and silicon, suggesting the use of an aluminum-silicate clay with calcite and iron-based pigments (for instance, ochers). On the second vessel (cat. 13), the artist used three colors—red, orange, and green—for the polychrome cartouches. In addition to calcite and clay, present in all three colors, both the red and orange contain cinnabar and iron-based minerals, and the green is a copper-phosphate pigment, similar to the pigments on the Jatz'oom Kuy vessel. The cartouches on the third vessel (cat. 12) bear a red composed of cinnabar and iron, comparable to the reds in the other vessels. Interestingly, two different tones of red paint occur in one of the cartouches. This could indicate the repair of a surface that was somehow damaged in antiquity (fig. 8). The darker red (possibly the older pigment) appears in the upper sector of the cartouche; it is composed of cinnabar on a layer of clay (aluminum silicate), which functioned here as the ground layer. The lighter red color in the lower sector of the cartouche is more similar to the hue of the other cartouches on the vase; the EDS elemental mapping of the cross section from the lighter red sample shows a mixture of calcite with aluminum-silicate clay, and on top is a thin layer of an iron-based pigment (fig. 7). The differing compositions indicate the two areas were applied to the vessel at different times.

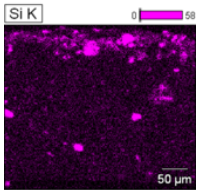
After painting these cartouches, the artists used a black pigment to execute the glyphs and images on all three vases. This is likely carbon black—a determination based on the strong infrared absorption visible in infrared images of the objects and the failure of pXRF spectroscopy to detect characteristic elements of any other black pigment.

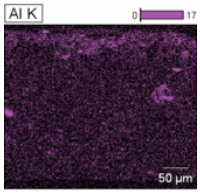
13 For explanations of these and other methods of scientific analysis used in this study, see Laura Maccarelli and Charlotte Eng, "Scientific Methods of Analysis," in this volume.











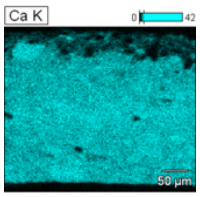
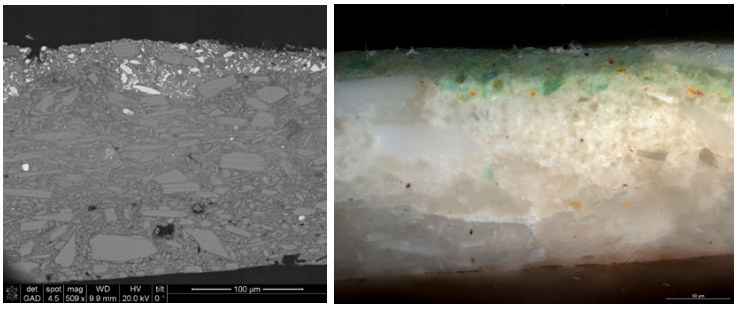


Fig. 5
Cross section under PLM and SEM-EDS of the Jatz'oom Kuy, or Spearthrower Owl, vessel (cat. 14; elemental maps and micrographs by Charlotte Eng and Laura Maccarelli, LACMA Conservation Center)



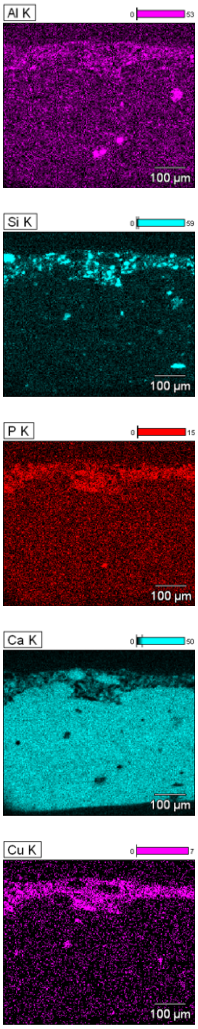
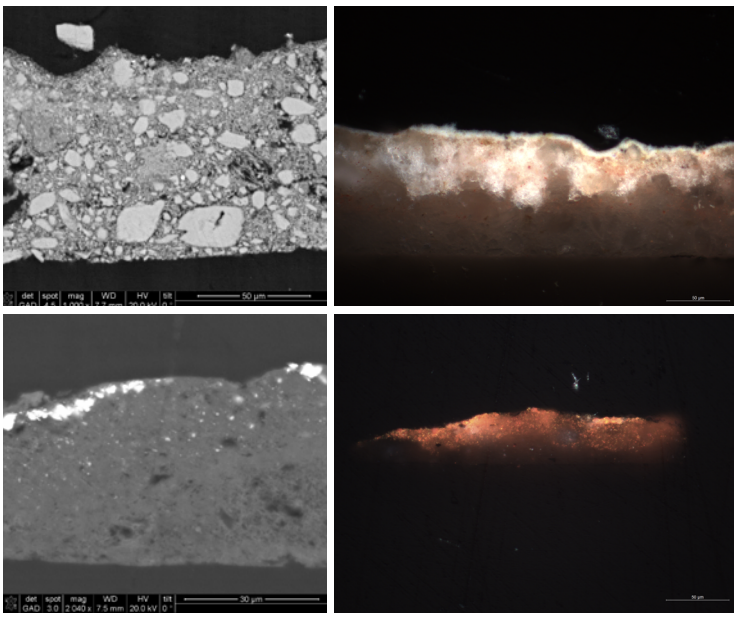


Fig. 6
Cross section under PLM and SEM-EDS of a Teotihuacan-style lidded tripod cylinder vessel (cat. 13), LACMA, M.2010.115.1068a–b (elemental maps and micrographs by Charlotte Eng and Laura Maccarelli, LACMA Conservation Center)



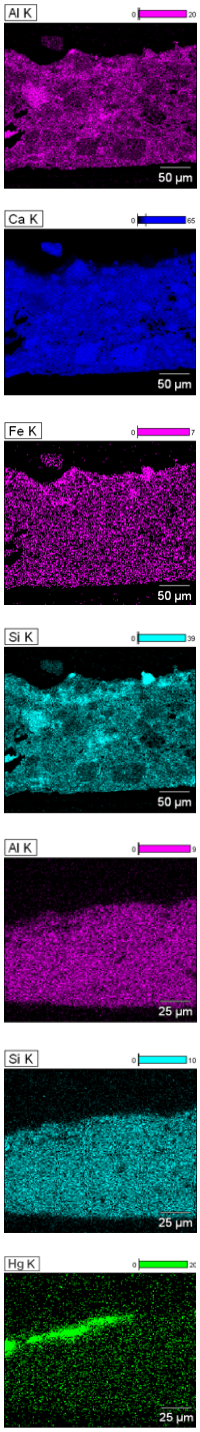


Fig. 7
Cross section under PLM and SEM-EDS of a Teotihuacan-style lidded tripod cylinder vessel (cat. 12), LACMA, M.2010.115.1066a–b (elemental maps and micrographs by Charlotte Eng and Laura Maccarelli, LACMA Conservation Center)

Fig. 8
UVF photograph of a Teotihuacan-style lidded tripod cylinder vessel (cat. 12), indicating restoration (white fluorescence) (top), and detail of the roundel painted with two hues of red

In addition to the formal and stylistic elements connecting these three vessels, they employ similar lime plasters and pigments (copper-phosphate, cinnabar, and ochers) in their designs. Furthermore, their respective clay compositions indicate the three ceramics originated in the same place, and although they all may have been made in the same region or workshop, the very close relationship between the clay compositions of the second and third vessels (cats. 13 and 12) suggests that those two may have been made from the same batch of clay.[14]

Other stuccoed vessels exhibit very different characteristics, clearly originating elsewhere. For example, a lidded tripod cylinder vessel with the head of a cacao deity includes a dedicatory text labeling it as a *kakaw* vessel for Naatz Chan Ahk, a fifth-century ruler from Naranjo, Guatemala, who bears the *sak chuwen* title (cat. 15).[15] As with the three vessels described above, the artist slipped and burnished the exterior walls and lid of this vessel (where the stucco would be applied) before firing.[16] The feet take the shape of pillows, differing from those of vessels made in Teotihuacan but comparable to the aforementioned Maya ones. Here, the firing holes appear on the inside of the feet, which were painted postfire with a red iron-based pigment.

Like the cartouches on the Jatz'oom Kuy vessel, those on this vessel are diagonally divided, here, into blue-green and white regions. However, study of a cross section from the interface between the red background and the blue-green area in the cartouches shows that the painting technique differed. Each sector of color (red, cream, and blue-green) comprises a mixture of lime, clay, and pigments that is similar to those of other vessels in the study, but the artist employed a reserve technique. Specifically, the artist first applied a thin layer of white plaster and then a layer of light red made from an iron-based pigment (rather than cinnabar). Instead of covering the whole vessel with these two layers, the artist left the cartouches empty, later applying the cream color directly to the ceramic wall with no plaster layer. The artist still emulated Teotihuacan designs but executed them with different techniques.

This vessel bears a blue-green color on the lid's border and in the cartouches. Fourier transform infrared (FT-IR) spectroscopy identified malachite as the colorant. Observation under the PLM of the cross sections from the painted border on the lid and from a cartouche on the cylinder (the one with the *ajaw* glyph that is part of the vessel owner's name, following the *kakaw* glyph) shows that the pigment layer contains large particles of malachite closer to the surface and smaller crystals throughout (fig. 9). The preparer of this color mixed the malachite with slaked lime and clay to create a pigmented ground. This recalls what Anna O. Shepard and Robert E. Smith described as tinted stucco in Preclassic examples from Uaxactun and Kaminaljuyu.[17] Comparison with those stuccoes could provide insight into a significant artistic achievement of the ancient Maya. The use of tinted stucco and thick painting layers made with a mixture of clay, malachite or copper-phosphate, and lime produced a particular blue-green tone that would evolve into the pigment Maya blue, a radical technical innovation that allowed artists to create an easier and more stable blue pigment with local resources.

The last pigment the artist applied was carbon black, used to paint the glyphs, as with the previously discussed examples. Here, however, the painter incised the black lines into the stucco, mirroring techniques used on vessels at Teotihuacan and on one Maya example from Tikal Burial 10.[18] This is one illustration of the diverse techniques Maya artists used to craft these vessels and the varying manners in which artists working in different polities and workshops incorporated different Teotihuacan techniques and elements into their designs. While Early Classic Maya artists emulated the medium,

14 See Reents-Budet and Bishop, "Pottery of the Central and Eastern Peten," in this volume.

15 Simon Martin and Nikolai Grube, *Chronicle of the Maya Kings and Queens: Deciphering the Dynasties of the Ancient Maya*, 2nd ed. (London: Thames & Hudson, 2008), 70–71; Alexandre Tokovinine and Vilma Fialko, "Stela 45 of Naranjo and the Early Classic Lords of Sa'aal," *The PARI Journal* 7, no. 4 (Spring 2007): 1–14.

16 The lid's interior and the vessel bottom were neither slipped nor burnished; the vessel interior was slipped and burnished.

form, and style of stucco-painted vessels from Teotihuacan, they approached their own creations with diverse potting and painting techniques. These techniques, along with the manufacture of the stuccoes and pigments used to execute them, varied across sites, indicating a strong capacity for innovation and invention among Maya artists.

17 Anna O. Shepard, "Technological Notes: Pottery," in *Excavations at Kaminaljuyu, Guatemala*, eds. Alfred V. Kidder, Jesse D. Jennings, and Edwin M. Shook (Washington, D.C.: Carnegie Institution of Washington, 1946), 261–77; Smith, *Ceramic Sequence*, 20.

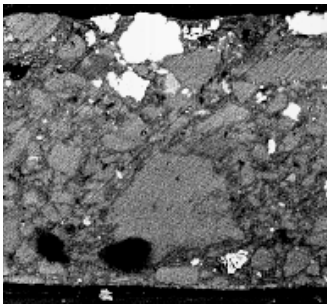
18 Coggins, "Painting and Drawing Styles at Tikal"; Fletcher, "Stuccoed Tripod Vessels from Teotihuacán," 142–43.

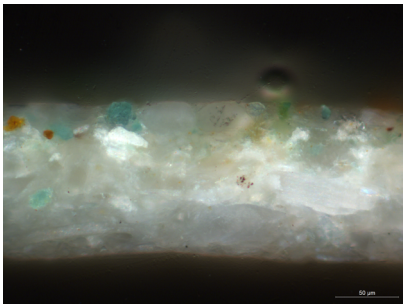
A Late Classic Maya Stucco-Painted Vessel

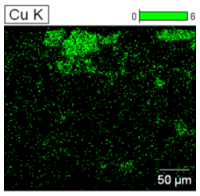
A very different stucco-painted vessel from a century or two later depicts supernatural musicians (cat. 16). It shares connections with those earlier examples, but certain stylistic characteristics of its decoration resemble Late Classic Maya mural painting at places such as Bonampak, in the Mexican state of Chiapas. Like the earlier Maya vessels, the exterior surface was slipped and burnished before firing. After the firing, the artist first painted the vessel with Maya blue (identified with near-infrared false-color [FCIR] imaging and FORS). This essentially constitutes a tinted plaster layer. Within this layer, a higher proportion of lime-plaster matrix and fewer fillers produced a more stable plaster, suggesting that Maya artists experimented and learned to improve their materials (fig. 10).

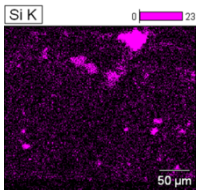
After applying the Maya blue layer, the artist added a white layer (calcite) in particular areas to map the design, then cinnabar and ocher in different combinations of red and orange. While using analogous mixtures of pigments to those detected on the earlier vessels, here, the artist employed them to achieve a somewhat naturalistic image, creating and accentuating the volumetric forms of the bodies. Last, the artist added outlines and details in gray, composed of calcium mixed with carbon black (identified with Raman spectroscopy), and brown. The layering of pigments resembles the layering of pigments in Late Classic Maya mural painting, as at Bonampak.

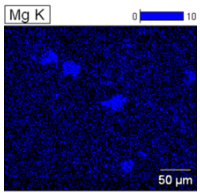
Within the limited sample of Maya vessels decorated with postfire painting in this project's study set, research has revealed similarities and diversity alike, as well as evidence of an advanced progression of technologies involving experimentation in manipulating stuccoes and pigments. These insights shed light on current understandings of artistic exchanges between Teotihuacan and the Maya lowlands as well as innovations of Maya artists experimenting with plaster and pigment recipes. The invention of Maya blue and its integration into the tradition of stucco painting on ceramic vessels also play key roles. Future study of postfire painting on Preclassic Maya ceramic vessels would provide useful comparative information to better understand the long tradition of this art form in the Maya region and any influence of technologies from Teotihuacan, as well as influences on Teotihuacan art from Maya artistic practices.











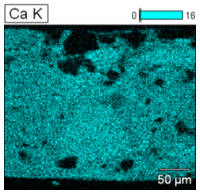
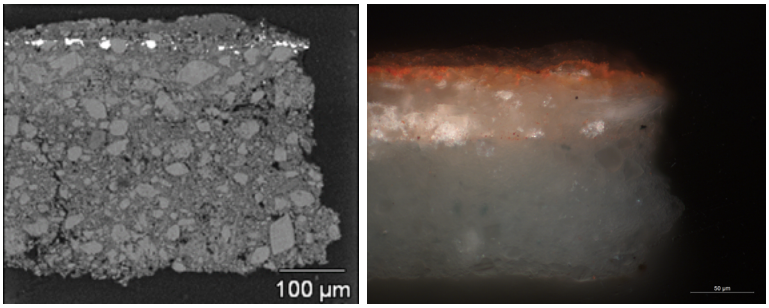


Fig. 9
Cross section from edge of lid (light green border) under PLM and SEM-EDS of a tripod cylinder vessel with the name of a Naranjo ruler (cat. 15; elemental maps and micrographs by Charlotte Eng and Laura Maccarelli, LACMA Conservation Center)



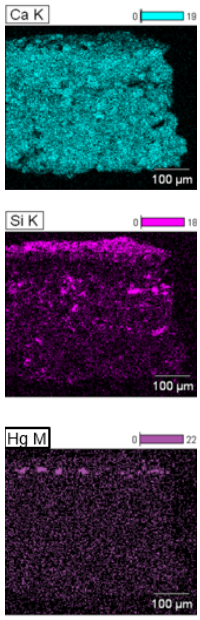


Fig. 10
Cross section under PLM and SEM-EDS of a tripod vessel with supernatural musicians (cat. 16; elemental maps and micrographs by Charlotte Eng and Laura Maccarelli, LACMA Conservation Center)

cm
LACMA CONSERVATION CENTER
BY YOSI A. R-POZEILOV
DC
QPCARD 201

Technical Catalogue

Introduction to the Catalogue

In this catalogue, the project's twenty-five vessels have been grouped together in five sets, each of which highlights one aspect of Classic Maya vase making and the artists who perfected it. Many of these vessels are exemplary of numerous techniques and could have been included in more than one grouping; thus, these groups should be seen as arbitrary divisions intended to provide the catalogue added structure, thereby fostering a constructive discussion of techniques that extends beyond individual catalogue entries.

Group 1, Exemplars of Calligraphy and Line, includes five vessels that exemplify controlled, calligraphic lines in their painted figural scenes and hieroglyphic texts. This style, associated with the royal courts of the Kaanul dynasty of Calakmul, Mexico, and affiliated polities, and more commonly known as the "codex style," privileges line over color in its depiction of supernatural themes. The six vessels of Group 2, Exemplars of Polychrome Engobe, exhibit the range of techniques Classic Maya artists employed to produce complex color palettes with ceramic paints. These span various geographic regions and iconographic styles, and demonstrate different approaches to the challenges of transforming pigments through fire. The five vessels of Group 3, Exemplars of Postfire Stucco Painting, are painted with stucco and pigments postfire. Analysis of these vessels reveals the formulations artists used to produce vibrant colors that adhered to stuccoed ceramic walls, and how these formulations changed over time. The four vessels of Group 4, Exemplary Forms, highlight some of the inventive techniques Classic Maya potters employed to produce complex forms from clay. Finally, Group 5, An Exemplary Tradition, assembles five vessels that showcase the expressive repertoire of a constellation of workshops based in northeastern Peten, Guatemala, from the traits the vessels share (e.g., a tall, cylindrical form and a limited color palette) to those that distinguish individual artists, workshops, or schools (e.g., distinctive temper and engobe formulations). Included in this category is one vessel made by nonlocal artists using a nonlocal painting style that appropriates elements of the region's aesthetic tradition (cat. 22), providing insight into the tradition and its repertoire from a contemporary outsider.[1]

Note to Readers: Throughout the catalogue entries, analytical methods and imaging techniques are referred to with acronyms. Explanations of these techniques can be found in "Technical Imaging," by Yosi Pozeilov, "Scientific Methods of Analysis," by Laura Maccarelli and Charlotte Eng, and "Insights into Maya Ceramic Techniques with Digital X-Radiography," by Megan E. O'Neil and John W. Hirx, in this volume. Furthermore, certain concepts and interpretive frameworks are repeated between entries to ensure that each catalogue entry can be understood on its own.

Note on Authorship: Art historical and epigraphic entries were written by Megan E. O'Neil. Technical entries were co-authored by Diana Magaloni, John W. Hirx, Laura Maccarelli, Megan E. O'Neil, and Alyce de Carteret. Laura Maccarelli and Charlotte Eng performed the microscopy and EDS elemental mapping for the stuccoed vessels of Group 3. The X-radiography was produced jointly by Yosi Pozeilov and Laura Maccarelli. All other technical imaging appearing in this catalogue is by Yosi Pozeilov.

1
See Dorie Reents-Budet and Ronald L. Bishop, "Pottery of the Central and Eastern Peten: A Study of Chemistry and Style," in this volume.

Group 1

Exemplars of Calligraphy and Line

Cat. 1

Cylinder Vessel with Way Entities

Northern Peten, Guatemala, or southern Campeche, Mexico, 680–750 CE
Engobe-painted ceramic
Height: 5 1/8 in. (13 cm); diameter: 5 3/8 in. (13.7 cm)
Gift of the 2006 Collectors Committee
M.2006.41
K531

This codex-style vessel portrays supernatural creatures with multiple animal attributes: a jaguar with deer antlers and a *k'in* (sun) sign on its belly; a toad holding a plate with a disembodied hand and eyeball; and a serpent with deer features from whose mouth emerges the hunting god Zip blowing a conch shell. They are named as the *way* of a ruler of the Kaanul (Snake) kingdom, the emblem glyph associated with Calakmul, Mexico, during the Late Classic period (600–800 CE). *Way* creatures relate to sleeping and dreaming and are denizens of darkness. Those named as belonging to rulers may have been their alter egos who wandered during sleep.[1] Although some seem cute or humorous, others are portrayed as frightening beings with eyeballs protruding from their sockets or holding plates of human bones. Some of their names are analogous to those of diseases described in sixteenth-century Maya sources, and they may have been personified illnesses sent as curses to harm rivals.[2] If so, they were part of supernatural warfare that could have taken place alongside overt military aggression.

1 Stephen D. Houston and David Stuart, *The* Way *Glyph: Evidence for "Co-Essences" among the Classic Maya* (Washington, D.C.: Center for Maya Research, 1989).

2 Nikolai K. Grube and Werner Nahm, "A Census of Xibalba: A Complete Inventory of Way Characters on Maya Ceramics," in *The Maya Vase Book: A Corpus of Rollout Photographs of Maya Vases*, vol. 4, ed. Justin Kerr (New York: Kerr Associates), 686–715; Christophe Helmke and Jesper Nielsen, "Hidden Identity and Power in Ancient Mesoamerica: Supernatural Alter Egos as Personified Diseases," *Acta Americana* 17, no. 2 (2009): 49–98.

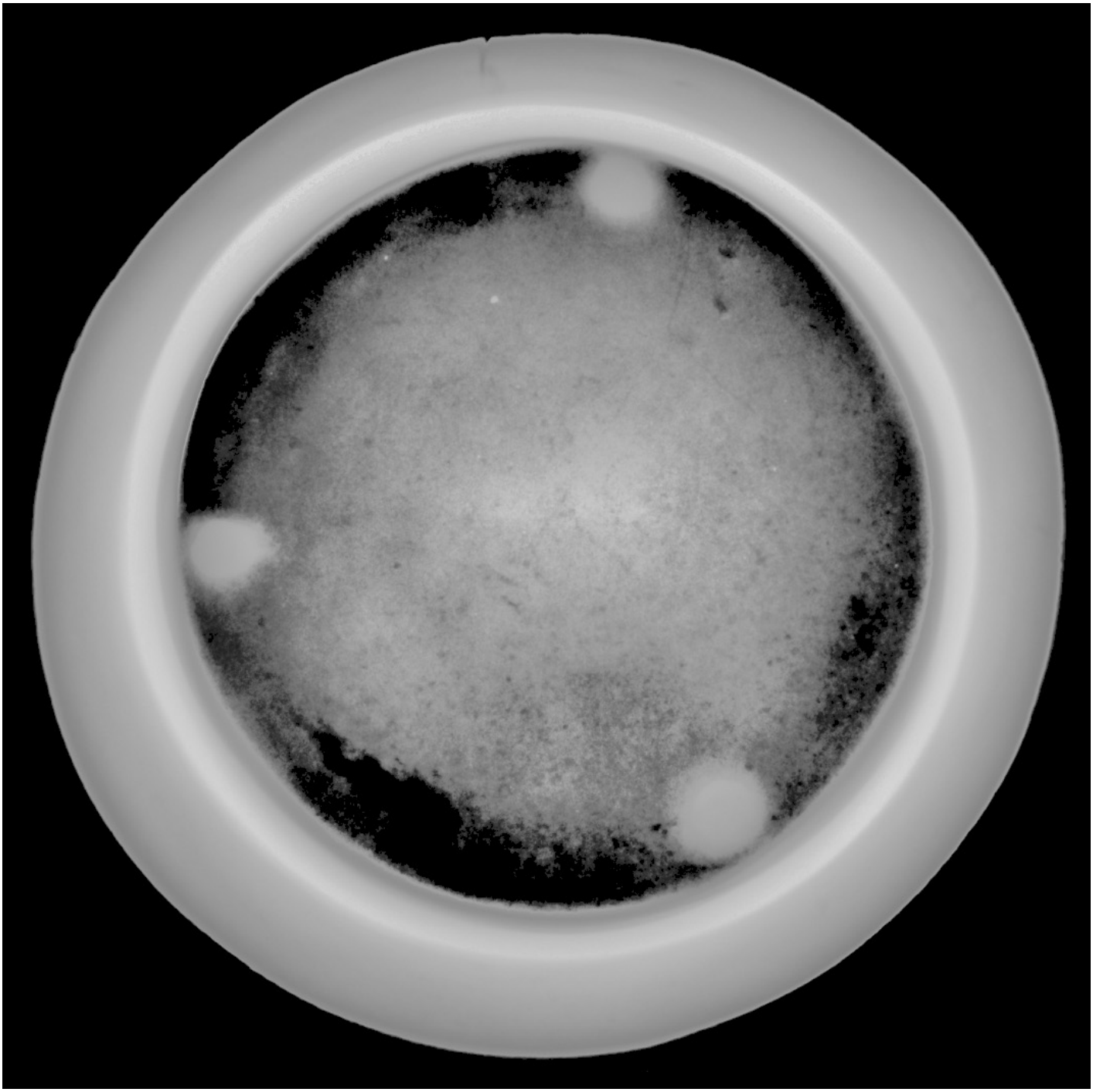
Cat. 1

Studies of Manufacturing Techniques

X-Radiography

Radiographs reveal aspects of the vessel's manufacture: Dark areas pertain to thin, porous material or voids (e.g., where organic inclusions burned out during the firing process), while denser areas and materials with higher atomic weight appear white or light gray. Horizontal bands of lighter and darker gray running along the walls of the vessel, faintly visible in the first radiograph, indicate the process of coiling. The radiograph of the bottom of the vase reveals how the floor was created. The black area around the perimeter shows where the potter pressed the coils and made them extremely thin, with the thickness increasing toward the center, which appears light gray. Three small balls of clay, attached to the base by pinching, comprise the vessel's feet. The frontal view shows that the vessel tilts to one side and that the floor is slightly concave, suggesting that the three feet served a structural purpose, to help the cylinder stand straight.
The concavity of the floor, together with the extreme thinness of its perimeter, might indicate production by an unskilled ceramicist, perhaps an apprentice. As this contrasts with the masterful painting of the motifs in the surface decoration, two different artisans may have produced this vessel.

Cat. 1



Rollout Photography

This codex-style vessel exemplifies the standard procedures that Classic Maya ceramic painters followed. The artist first covered the exterior walls of the clay body with a layer of white engobe as a primer. Though the nature of this base layer is not completely understood, the primer likely derives from a clay in the montmorillonite (smectite) family.[3] The artist then applied a second layer of white engobe, likely mixed with a whitening agent. Both of these layers are visible in an area of surface loss on the vessel wall (see fig. 1). Once these two white engobes had been applied, the painted figures and glyphs were rendered with a manganese-based engobe. The last color applied was the iron-based red engobe, which comprises the bands at the rim and the base, and which coats the interior of the vessel in a diluted form (fig. 2). The manganese and iron in these respective engobes were identified using pXRF analysis.

Fig. 1
Detail image of an area of surface loss on the exterior of the vessel, revealing the base layer of white engobe

Fig. 2

FCIR Imaging

Physical evidence of the painting process, invisible to the naked eye, becomes apparent in FCIR images; thus, researchers can use them to reconstruct painting techniques, identify pigments, and pinpoint instances of modern restoration. Through shifts in color, FCIR helps to identify the components of black ceramic paint, or engobe: Manganese-based pigments appears reddish brown in infrared images, while carbon black pigment takes on a greenish-gray hue. The reddish tone of the black lines on this vessel indicates the likely use of manganese-based pigments. The yellow tone of the red bands at the vessel's rim and base likely pertains to an iron-based engobe. Additionally, the patches of dark gray observed in the basal band probably correspond with the localized reduction of iron oxide during firing, a phenomenon commonly referred to as "fire clouds."

3
Montmorillonites comprise a subgroup of the smectite group of clay minerals, itself formerly known as the montmorillonite group; XRD analysis identified smectite in the ground layer of engobe on a sherd at New York's Metropolitan Museum of Art (Federico Carò, personal communication, 2018). Also see John W. Hirx "From a Karst Landscape to Majestic Vessels: Reconstructing Ancient Maya Ceramic Practices," in this volume.

Cat. 1

Cat. 1

Cat. 2

Cylinder Vessel with Dynastic List of the Kaanul (Snake) Kingdom

Northern Peten, Guatemala, or southern Campeche, Mexico,
680–750 CE
Engobe-painted ceramic
Height: 6 1/2 in. (16.5 cm); diameter: 5 5/8 in. (14.3 cm)
Purchased with funds provided by Camilla Chandler Frost
M.2010.115.1
K6751

This codex-style vessel bearing a dynastic list of the Kaanul (Snake) kingdom is one of twelve known dynastic vases of this illustrious political entity.[4] The dynastic list is composed of multiple phrases with a basic structure—a date, *uch'am K'awiil* ("[it is] the K'awiil-taking," an accession verb), the dynast's name, and the Kaanul emblem glyph—although in some there is no emblem glyph. The start of each phrase is in red and black-brown, and the rest is painted in black-brown. The dates do not correlate with the king list from Late Classic (600–800 CE) Calakmul, Mexico, where the Kaanul kingdom was centered after 631 CE and at the time of this vessel's production.[5] However, Simon Martin argues that it correlates with a king list from the Early Classic period (250–600 CE), when the Kaanul kingdom was centered at Dzibanche, Mexico, and lists the first nineteen rulers of the dynasty.[6] Given this is a Late Classic vessel, the list is thus retrospective, honoring earlier rulers of this powerful kingdom that had distinct capitals over the centuries.[7]

4
Simon Martin, "Secrets of the Painted King List: Recovering the Early History of the Snake Dynasty," *Maya Decipherment: Ideas on Ancient Maya Writing and Iconography* (blog), May 5, 2017, https://decipherment.wordpress.com/2017/05/05/secrets-of-the-painted-king-list-recovering-the-early-history-of-the-snake-dynasty/.

5
Martin, "The Painted King List: A Commentary on Codex-Style Dynastic Vases," in *The Maya Vase Book: A Corpus of Rollout Photographs of Maya Vases*, vol. 5, ed. Justin Kerr (New York: Kerr Associates, 1997), 847–67; Martin, "Secrets of the Painted King List" (blog), May 5, 2017.

6
Martin, "Secrets of the Painted King List," *Maya Decipherment* (blog), May 5, 2017.

7
Grube, "El Origen de La Dinastía Kaan," in *Los Cautivos de Dzibanché*, ed. Enrique Nalda (Mexico City: Consejo Nacional para la Cultura y las Artes and Instituto Nacional de Antropología e Historia, 2004), 117–31; Martin, "Of Snakes and Bats: Shifting Identities at Calakmul," *The PARI Journal* 6, no. 2 (Fall 2005): 5–13; Martin and Grube, *Chronicle of the Maya Kings and Queens: Deciphering the Dynasties of the Ancient Maya*, 2nd ed. (London: Thames & Hudson, 2008).

Cat. 2

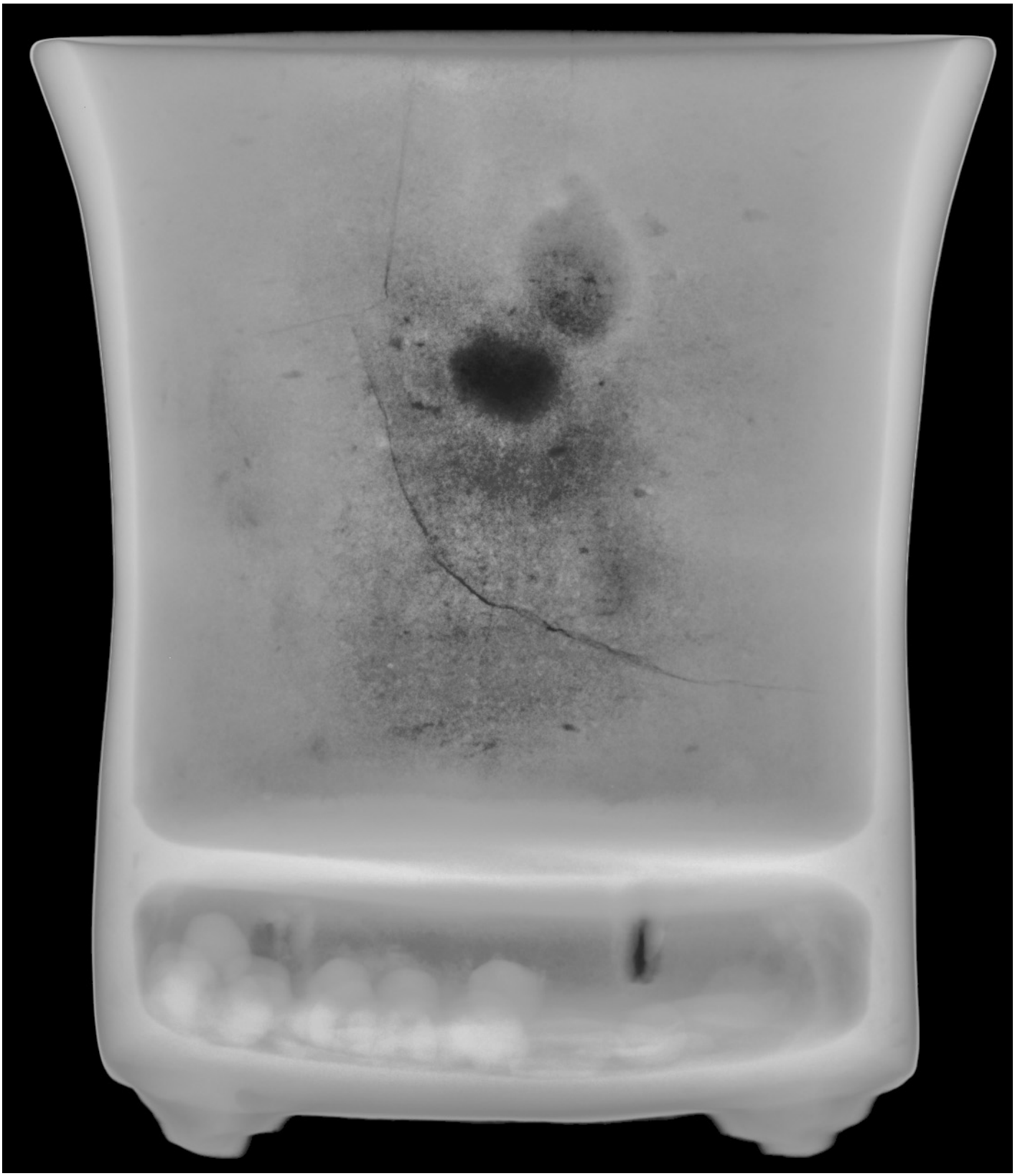
Studies of Manufacturing Techniques

X-Radiography

X-radiographs show the craft the ceramicist used to create this structurally complex vessel. The most surprising trait is the chamber in the vessel's base that holds a group of ceramic balls, enabling the vessel to function as a rattle. Four slits in the sealed chamber not only allow for the passage of sound but also would have allowed steam to escape the chamber when the vessel was fired. The coil construction is discernible in the vessel walls as light horizontal bands, and depressions made by the potter's fingers as they pressed and pinched the coils appear in the radiograph as rounded dark forms.

The clay body exhibits evidence for the use of both organic siccatives, which appear as small dark voids where the material burned out during firing, as well as inorganic temper, which reads as small light gray points distributed evenly throughout the vessel. The distribution and size of these particles suggest a special kind of temper called *sah kab* by present-day Maya potters from Ticul, Mexico.[8] *Sah kab* is composed of marl, a mixture of fine-grained calcium- and clay-containing components typical of the soils of the Yucatan Peninsula. Spectroscopic analysis using pXRF, which identified calcium and aluminum among the elements present in the clay body, seems to supports this hypothesis.

8 Dean E. Arnold, *Maya Potters' Indigenous Knowledge* (Boulder, CO: University Press of Colorado, 2018), 73–74, 88–90, 116. For earlier references to *sah kab* (or *sascab*) used as pottery temper, see Raymond H. Thompson, *Modern Yucatecan Maya Pottery Making* (Salt Lake City: Society for American Archaeology, 1958), 68–69.



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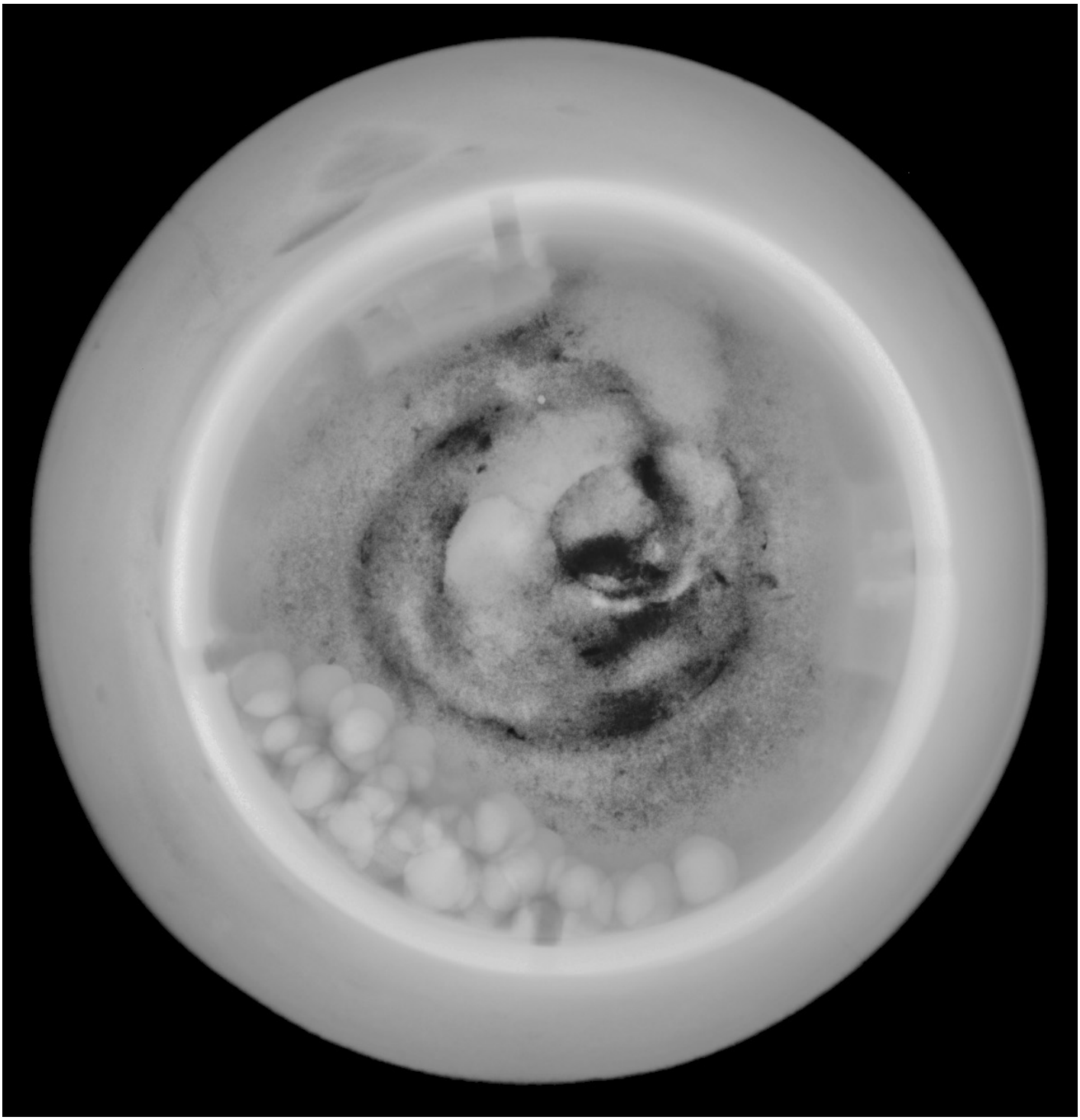


Rollout Photography

The vessel's painting process can be determined upon close examination of the vessel and high-resolution visible-light photography. After applying a primer layer of white engobe, the artist added a second layer to color the background. Then, the glyphs were rendered in a single sitting. The varying translucence of the black lines suggests execution with a brush loaded with different concentrations of black engobe. Those painted with a lightly loaded brush were kept as is with no retracing. Finally, the painter used an iron-rich red paint to provide accents of color, carefully respecting even the most diluted of black traces (fig. 3).

The slits in the rattle chamber cut through the glyphs, so the sound produced by moving the vessel seems to emanate from the writing. These slits had to be opened before firing, and they were likely already there when the painter planned the composition.

FCIR Imaging

In FCIR, the black engobe appears reddish brown, suggesting the use of an engobe rich in manganese-based minerals. Some glyphs, however, reflect black, indicating instances of modern restoration with a distinct carbon-based pigment (fig. 4). By studying the glyphs, one can observe the strokes of the loaded brush from beginning to end: Strokes begin in areas where the paint is thicker and darker, and end in lighter areas where the brush was almost empty. Thus, one can follow the movement of the painter's hand. The glyph columns follow a rectilinear grid that cannot be discerned through FCIR imaging, suggesting that the artist either created the grid in the imagination (an indication of expert-level mastery of the craft) or with an organic ink that burned during firing.[9]

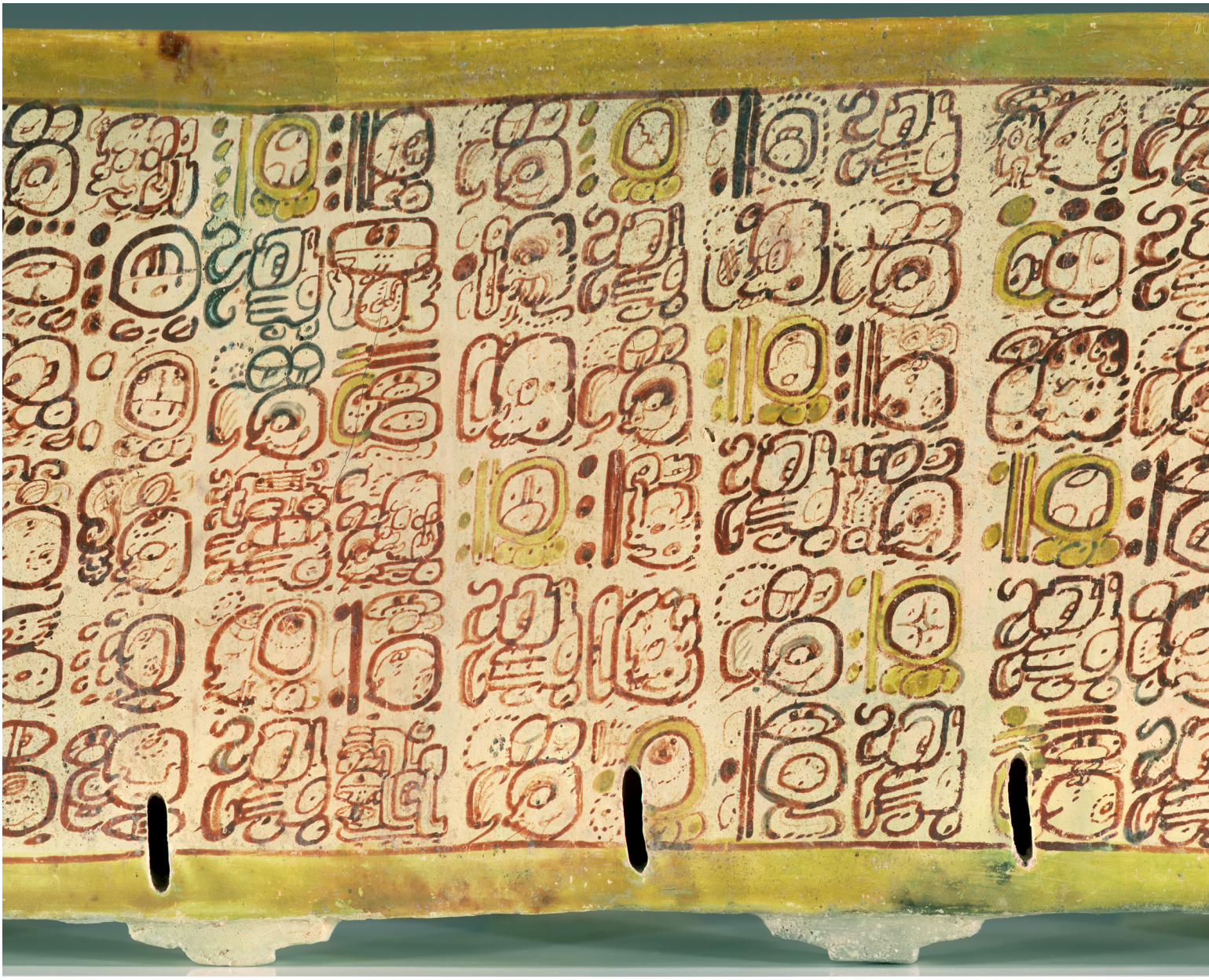
Fig. 3
Detail highlighting the carefully painted red engobe within black contour lines, which appear in variable concentrations

Fig. 4
Detail of FCIR image showing the original manganese-based engobe (reflecting reddish brown) and areas of modern restoration (reflecting black)

9
Susan Peterson and Jan Peterson, *The Craft and Art of Clay* (1992), 4th ed. (Woodstock and New York: Overlook Press, 2003), 21.

Cat. 2

Cat. 2



Cat. 2

UVF Photography

This image, taken under ultraviolet light, provides an additional means to differentiate modern restoration from the original paint. The bright spot was rendered with paint that has a synthetic material in its formula, and thus has a more luminous fluorescence than the clay-based engobes.

Cats. 3 and 4
Codex-Style Cylinder Vessel with Avian Maize God
(M.2010.115.462, K1387)

Codex-Style Bowl with Avian Maize God
(M.2010.115.461, K1388)

Northern Peten, Guatemala, or southern Campeche, Mexico,
680–750 CE
Engobe-painted ceramic
Vessel: height 5 1/2 in. (13.9 cm); diameter: 3 7/10 in. (9.4 cm)
Bowl: height 2 1/2 in. (6.4 cm); diameter: 6 3/4 in. (17.3 cm)
Purchased with funds provided by Camilla Chandler Frost

Painted on this matching cup and bowl are repeating images of the Maize God as a hummingbird, with a flower on its long beak. This avian Maize God is adorned with heavy jewels, likely jade, and there are bundles in front of each figure. On the cup, the avian Maize God is set between a sky and earth band, situating him within the cosmos; above is a dedication text. On the shorter bowl, only the birds are shown between the two red-painted rims.

The dedication text encircling the cup names it as a *yuk'ib* (drinking vessel) of Janaab Ti' O', lord of Hix Witz (Jaguar Mountain), an ancient name used at Zapote Bobal, El Pajaral, and La Joyanca, in the Peten, Guatemala.[10]

The paintings are similar to that on a vessel discovered in the royal tomb of Chak Tok' Ich'aak at Calakmul, Mexico (Structure 2, Burial 4).[11] Chemical analysis of the ceramic paste by the Maya Ceramics Project indicates the clay used for the cup and bowl does not match that of any known site in the region, either at Calakmul or in the Mirador Basin, Guatemala, and that it may have come from a place for which the project's ceramics database has no samples.[12] That place likely was affiliated with the Kaanul (Snake) kingdom, centered at Calakmul after 631 CE.[13]

10
Stuart, "La Identificación de Hixwitz," presented at the XV Simposio de Investigaciones Arqueológicas en Guatemala, Museo Nacional de Arqueología y Etnología de Guatemala, Guatemala City, 2001; Martin and Reents-Budet, "A Hieroglyphic Block from the Region of Hiix Witz, Guatemala," *The PARI Journal* 11, no. 1 (Summer 2010): 1–6; James Fitzsimmons, "Janaab' Ti' O' and the Transformation of Zapote Bobal, Guatemala," *Research Reports on Ancient Maya Writing* 63 (August 2012): 1–21; Bryan Just, *Dancing into Dreams: Maya Vase Painting of the Ik' Kingdom*, exh. cat. (Princeton, NJ: Princeton University Art Museum; New Haven, CT; Yale University Press, 2012), 83.

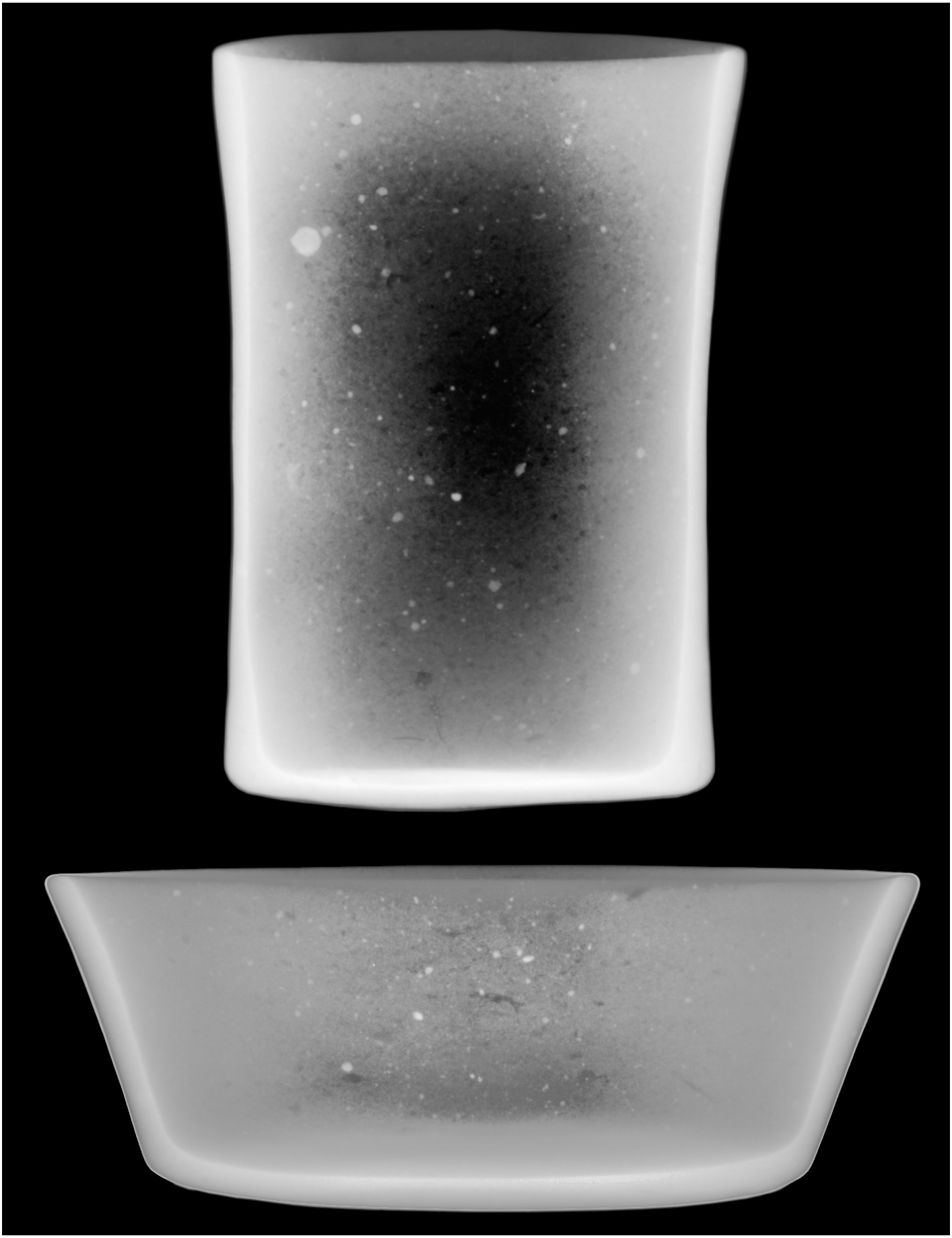
11
Ramón Carrasco Vargas, Sylviane Boucher, Paula Alvarez González, Vera Tiesler Blos, Valeria García Vierna, Renata García Moreno, and Javier Vázquez Negrete, "A Dynastic Tomb from Campeche, Mexico: New Evidence on Jaguar Paw, a Ruler of Calakmul," *Latin American Antiquity* 10, no. 1 (March 1999): 47–58; Martin and Reents-Budet, "A Hieroglyphic Block from the Region of Hiix Witz, Guatemala," 1–6.

12
Dorie Reents-Budet, Sylviane Bouche Le Landais, Ronald L. Bishop, and M. James Blackman, "Codex-Style Ceramics: New Data Concerning Patterns of Production and Distribution," paper presented at the XXIV Simposio de Investigaciones Arqueológicas en Guatemala, Museo Nacional de Arqueología y Etnología, Guatemala City, July 19, 2010; Martin and Reents-Budet, "A Hieroglyphic Block from the Region of Hiix Witz, Guatemala," 1–6.

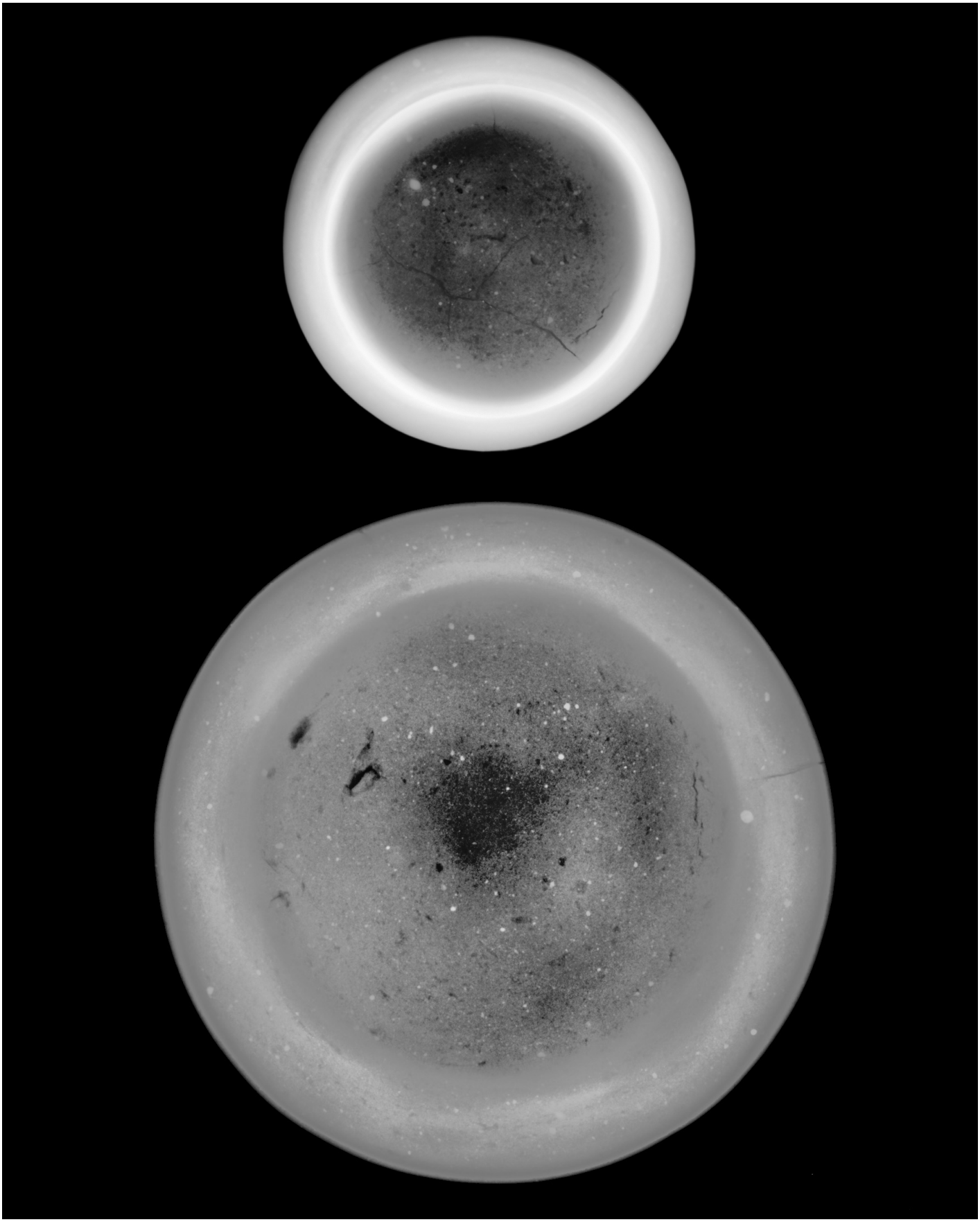
13
Martin and Reents-Budet, "A Hieroglyphic Block from the Region of Hiix Witz, Guatemala," 1–6.

X-Radiography

X-radiographs of the cup and bowl reveal similar clay bodies for the two vessels. Both include various tempers. Larger inclusions that refract as white are high-density particles that could be inorganic inclusions like feldspar sands; however, material analysis like XRD would need to be conducted to determine their mineral composition. Smaller, well-distributed inclusions that appear gray (like those observed in other vessels) likely pertain to the calcareous clay known as *sah kab*. This combination of tempers would have made the clay manageable while wet and conferred thermal shock resistance on the ware during firing. Radiographs also show that both vessels were hand built with coils, though their facture differs. The bowl has walls of even thickness, while those of the cup are uneven. This may indicate production by different potters working side by side with the same clay, or it may be attributed to the challenges of modeling more constricted vessel forms.



Cats. 3 and 4



Rollout Photography and FCIR Imaging

The cup and bowl likely originated in the same workshop. In addition to their comparable clay bodies, they share similar painting styles. However, the diluted black engobe used to paint the bowl behaves differently than that of the cup, which underwent thermal expansion in the firing process, creating a crackled appearance (fig. 5). The color palette of each vessel is simple. A white-cream engobe (likely derived from kaolinite or montmorillonite clay) was applied on top of a primer and then smoothed by burnishing. The artist(s) used different concentrations of a black engobe to produce a watercolor effect. The agile contour lines combine with a diluted gray wash to create a distinctive painting style. In FCIR imaging, the black engobe acquires a reddish-brown hue, suggesting the use of manganese-based mineral as a colorant. The bands of red at the rim and base of each vessel shift to yellow, and may pertain to an iron-based engobe.

Fig. 5
Details showing the differing behavior, in terms of thermal expansion, of the diluted black engobe on the bowl (left) and on the cup (right). Note the crackled appearance of the gray wash coloring the tail of the avian Maize God figure (right).

Cat. 5

Cylinder Vessel with Supernatural Birth Scene

Northern Peten, Guatemala, or southern Campeche, Mexico, 680–750 CE
Engobe-painted ceramic
Height: 6 1/2 in. (16.5 cm); diameter: 5 5/8 in. (14.3 cm)
Purchased with funds provided by Camilla Chandler Frost
M.2010.115.3
K5164

A painted supernatural birth scene wraps around the cylinder of this codex-style vessel. Here, a seated female with crossed legs leans back, her hand resting on the floor. Her breasts are bare, and wrapped around her abdomen is a large serpent that is an extension of the serpentine leg of K'awiil, deity of lightning and transformation. K'awiil looks backward toward the other end of the serpent body, which has a large bearded-serpent head from which an aged male deity emerges. He reaches toward the female with outstretched hands. It has been suggested that the old god reaches toward the sexualized goddess in an aggressive, lecherous manner.[14] While this is possible, another option is that it portrays a scene of supernatural birth and transformation. An accompanying inscription names the birth (*sihyaj*) of a deity.[15] Indeed, the aged god's reaching toward the woman's breasts may relate to the potential use of nipple stimulation, which produces the hormone oxytocin in a woman's body, as a way to induce uterine contractions and labor.[16] The image may thus connect to the text mentioning a supernatural birth. Other codex-style vessels, including two at LACMA, bear cognate scenes.[17]

14
Andrea Stone, "Sacrifice and Sexuality: Some Structural Relationships in Classic Maya Art," in *The Role of Gender in Precolumbian Art and Architecture*, ed. Virginia Miller (Lanham, MD: University Press of America, 1988), 75–103; Stone, "Keeping Abreast of the Maya: A Study of the Female Body in Maya Art," *Ancient Mesoamerica* 22, no. 1 (Spring 2011), https://doi.org/10.1017/S0956536111000137, 176.

15
Luís Lopes, "A New Look at the Name Phrase of the 'Snake Lady,'" *Wayeb Notes* 19 (2005), http://www.wayeb.org/notes/wayeb_notes0019.pdf.

16
Kyllike Christensson, Bo A. Nilsson, Solveig Stock, Ann Sofie Matthiesen, and Kerstin Uvnäs-Moberg, "Effect of Nipple Stimulation on Uterine Activity and on Plasma Levels of Oxytocin in Full Term, Healthy Pregnant Women," *Acta Obstetricia et Gynecologica Scandinavica* 68, no. 3 (2009): 205–10.

17
See, for instance, LACMA, M.2010.115.4 and M.2010.115.234.

Cat. 5

Studies of Manufacturing Techniques

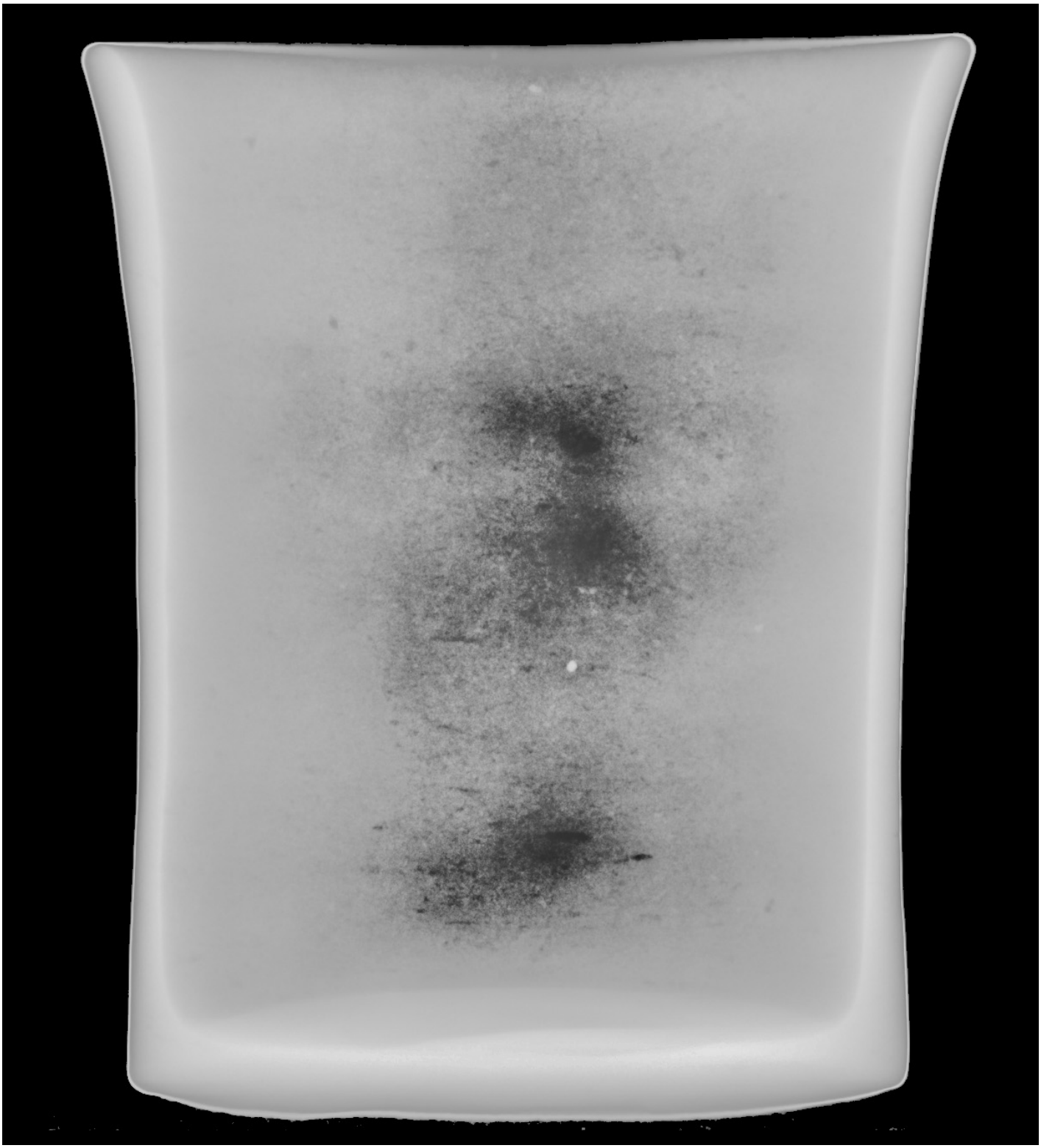
X-Radiography

X-radiographs show that the clay body was prepared by adding organic siccatives, likely seeds, which appear as tiny black spots and elongated voids. The incorporation of organic inclusions suggests a naturally sticky clay, and, in this respect, the clay body differs from that of other vessels in this group (cats. 1, 3, and 4). Neutron activation analysis (NAA) of this vessel's clay body, conducted by Ronald L. Bishop and Dorie Reents-Budet, indicates production near Nakbe, Guatemala, also indicated for cat. 1, which suggests the potters of these vessels exploited a similar clay source.[18] The clay body of cat. 5 was also amended with extremely fine inorganic temper, likely finely ground marl, or *sah kab*, which appears as small gray particles on the radiograph. As is conveyed by the horizontal orientation of the voids left by the organic siccatives, the vessel was formed through the process of coil building.

UVF Photography

Under ultraviolet light, areas of white fluorescence reveal the application of a synthetic consolidant as a modern conservation treatment.

18 Doree Reents-Budet et al., *Painting the Maya Universe: Royal Ceramics of the Classic Period*, exh. cat. (Durham, NC: Duke University Press in association with Duke University Museum of Art, 1994), 328.



Cat. 5

Rollout Photography

A master painter created this composition. Close observation notes the absence of underdrawings, and the deliberate strokes exhibit precise control of the saturation and dilution of the line, creating a scene full of energy yet without error (fig. 6). To paint an image like this, the artist would have rotated the cylindrical vessel, likely in a prone position, as it was painted. Thus, the ceramic paints had to be formulated to dry quickly in order to prevent smudging or smearing during handling. At the same time, the paint needed to flow continuously. All of this evidences an engineered slip, otherwise known as an engobe (see Hirx, this volume). The perfect viscosity of the black lines may also point to the use of additives (for example, polysaccharides or gums), which would have burned off during firing. The precision required for this painting technique involved masterful artistry as well as a specifically formulated engobe. This contrasts with cats. 3 and 4; these vessels utilized a more expressive line with complementary shading, achieving a markedly different aesthetic and suggesting a different workshop or origination.

Fig. 6
Detail highlighting the ability of the painter to create a graphic, energetic scene with precise and clean lines that contrast with the stillness of the glyphs

FCIR Imaging

The black pigment used to paint the figures reflects reddish brown in the FCIR image, identifying it as manganese-based pigments. The red band at the rim reflects yellow and likely pertains to the use of an iron-based ceramic paint. The band at the base of the vessel, however, discolored during firing, as clouds of smoke or burning fuel caused the iron to reduce. This firing cloud appears as a dark blue-green in the FCIR image.

Cat. 5

Cat. 5

Group 2

Exemplars of Polychrome Engobe

Cat. 6

Cylinder Vessel with Palace Scene

Dos Pilas or vicinity, Peten, Guatemala, 740–800 CE
Engobe-painted ceramic with postfire paint
Height: 7 1/8 in. (18.1 cm); diameter: 5 1/8 in. (13 cm)
Purchased with funds provided by Camilla Chandler Frost
M.2010.115.12
K1599

The image painted on this cylinder vessel portrays the enthroned K'awiil Chan K'inich, a prince of Dos Pilas or Tikal, Guatemala,[1] on a date before his accession to king, when nobles, including a royal youth, shared flower offerings, food, and drink. This has been interpreted as a scene portrayed retrospectively, after he ascended to rulership.[2] Bryan Just has identified the event as the prince's *joyaj* (debut) in the role of *baah te'* (literally, "head stick," or bailiff).[3]

This vessel is unusual in that it has a painter's signature, "Utz'ihb Akan Suutz'" ([it is] his painting, Groan Bat).[4] This phrase appears behind the prince's feathered headdress, indicating the artist's prominence. The figure seated before the prince wears a paintbrush in his headdress, suggesting he is an artist and perhaps even the painter of this scene. There are no other extant references to this artist, but his skills are abundantly clear on this exquisitely painted polychrome vessel in the balanced composition, clear lines, and successful experimentation with color.

There is debate about where this vessel was made. Dorie Reents-Budet and colleagues have argued that the vessel was made in the Petexbatun, in the region where Dos Pilas is located; however, Just argues it was made by artists from the Ik' kingdom, centered at Motul de San José.[5] Simon Martin and Nikolai Grube note that "a similar scene featuring a Dos Pilas king was excavated at Tikal."[6]

1
Simon Martin and Nikolai K. Grube, *Chronicle of the Maya Kings and Queens: Deciphering the Dynasties of the Ancient Maya*, 2nd ed. (London: Thames & Hudson, 2008), 60–62.

2
Dorie Reents-Budet et al., *Painting the Maya Universe: Royal Ceramics of the Classic Period* (Durham, NC: Duke University Press in association with Duke University Museum of Art, 1994), 320.

3
Bryan Just, *Dancing into Dreams: Maya Vase Painting of the Ik' Kingdom* (Princeton, NJ: Princeton University Art Museum; New Haven, CT: Yale University Press, 2012), 177.

4
Ibid., 177.

5
Reents-Budet, Stanley Guenter, Ronald L. Bishop, and M. James Blackman, "Identity and Interaction: Ceramic Styles and Social History of the Ik' Polity, Guatemala," in *Motul de San José: Politics, History, and Economy in a Classic Maya Polity*, eds. Antonia E. Foias and Kitty F. Emery (Gainesville: University Press of Florida, 2012), 67–93; Just, *Dancing into Dreams*, 177.

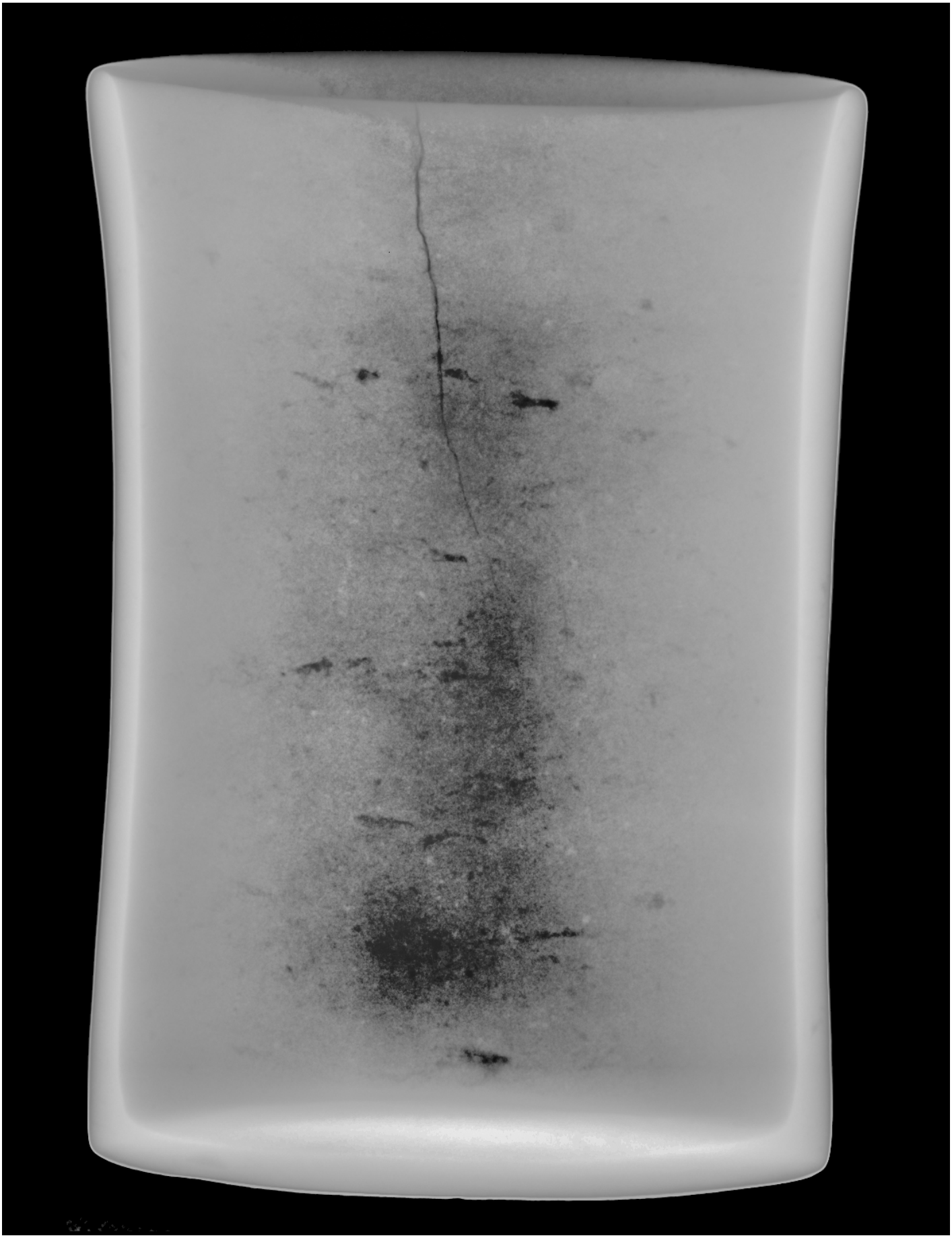
6
Martin and Grube, *Chronicle of the Maya Kings and Queens*, 62.

Cat. 6

Studies of Manufacturing Techniques

X-Radiography

Radiographs of this vessel show clear evidence for the use of organic siccatives and inorganic temper. The elongated, rectilinear black shapes pertain to voids left by burned-out organic siccatives, potentially thick grass, or chopped reeds. These elements run horizontally, following the orientation of the coiling process. The temper, which appears well distributed throughout the clay body as minute light-colored granules, is likely the coarse marl referred to by present-day Yucatec Maya potters as *sah kab*. The evenness of the wall thickness from floor to rim denotes high-quality craftsmanship. A crack, starting at the rim and propagating down the wall of the vessel (which is not unusual for such vessels) indicates that the ceramic suffered from pressure in the burial environment.



Visible Reflected Light and Rollout Photography

Photographs of the interior and base of the vessel highlight aspects of the painting process (fig. 1). The artist first applied a white primer to all surfaces except the base, and then followed with a second layer of white engobe as the vessel's background color. Surface loss at the rim makes these two layers evident. The rounded shapes decorating the interior rim, which may represent the tips of feathers or a foaming chocolate drink, were painted with a black engobe composed of manganese-based minerals, as identified with pXRF (fig. 2).

As with Classic-period (250–900 CE) mural painting in the Maya area, this vessel's palette was formulated to evoke realism in its composition, but with the restricted range of pigments that could survive the firing process. Each color occurs in two tones—black and gray, deep red and pink, bright orange and salmon, cream and luminous white—indicating manipulation of the ceramic palette to imitate that used in murals. Furthermore, the opaque and saturated appearance of these colored engobes ranks as a notable achievement. Once the vessel had been fired, the artist applied white gypsum to the feathers, jewelry, and faces of the ruler and attendants to create additional detail and further evoke realism in the scene.

FCIR Imaging

Through shifts in color, FCIR imaging reveals differences in the formulation of engobes that affect their tone and opacity. For instance, the deep red of the painted skin, which reflects a mustard yellow, is a translucent engobe applied in a thick layer, its clay particles pooling and dispersing across the area of its application. The pink of the throne and the salmon of the left-hand figure's skirt, by contrast, are opaque paints applied in thin even layers. Analysis using pXRF spectroscopy identified the black pigment of the outlines and the rim bands as a manganese-based engobe; the reddish-brown hue the pigment acquires in FCIR imaging aligns with this identification. A second black engobe, used to color the belt flaps adorning the enthroned figure (right) and the standing figure (left), reflects a greenish hue, indicating the use of a different pigment, likely carbon black. This same engobe also was used to color the jewelry, the feather headdresses, and the cacao pods.

Fig. 1
Photographs of the interior (left) and base (right) of the vessel

Fig. 2
Detail of the decoration of the vessel's interior wall, which may represent the tips of black feathers or a foaming chocolate drink

Cat. 6

Cat. 6

Cat. 6

UVF Photography

Under ultraviolet light, imprints left by roots during this vessel's interment become markedly apparent. Despite a significant amount of biodeterioration evident on the vessel, the engobe formulations exhibit notable durability. The contrast between the two white tones reveals the different mixtures of minerals used to produce each engobe: The calcium carbonate of the luminous white fluoresces brilliantly, while the cream color comprising the background, likely derived from montmorillonite (smectite) clay, remains dull under UV light.

Cat. 7

Cylinder Vase with Moon Goddess and Celestial Beings

Mexico or Guatemala, 600–900 CE
Engobe-painted ceramic
Height: 10 in. (25.4 cm); diameter: 3⁴/₅ in. (9.7 cm)
Purchased with funds provided by Camilla Chandler Frost
M.2010.115.628
K5166

In this mythological scene, an enthroned Moon Goddess—with a characteristic lunar crescent emerging from her arm—holds a rabbit, an animal associated with the moon.[7] Before them kneels God L, an underworld deity, shown submissive and stripped of his characteristic cloak and hat, which the rabbit holds.[8] Facing this group are four male figures; each has a lunar crescent, but their varying faces and bodies identify them as lunar patrons correlating with Glyph C of the Lunar Series.[9] This scene relates to a larger myth in which the rabbit has stolen God L's finery, a narrative presumably about the triumph of celestial bodies over underworld deities.

7
Stephen Houston, "Heavenly Bodies," *Maya Decipherment: Ideas on Ancient Maya Writing and Iconography* (blog), July 16, 2012, https://decipherment.wordpress.com/2012/07/16/heavenly-bodies/.

8
Oswaldo Chinchilla Mazariegos, *Imágenes de la mitología maya* (Guatemala City: Museo Popol Vuh, 2011), 208–9.

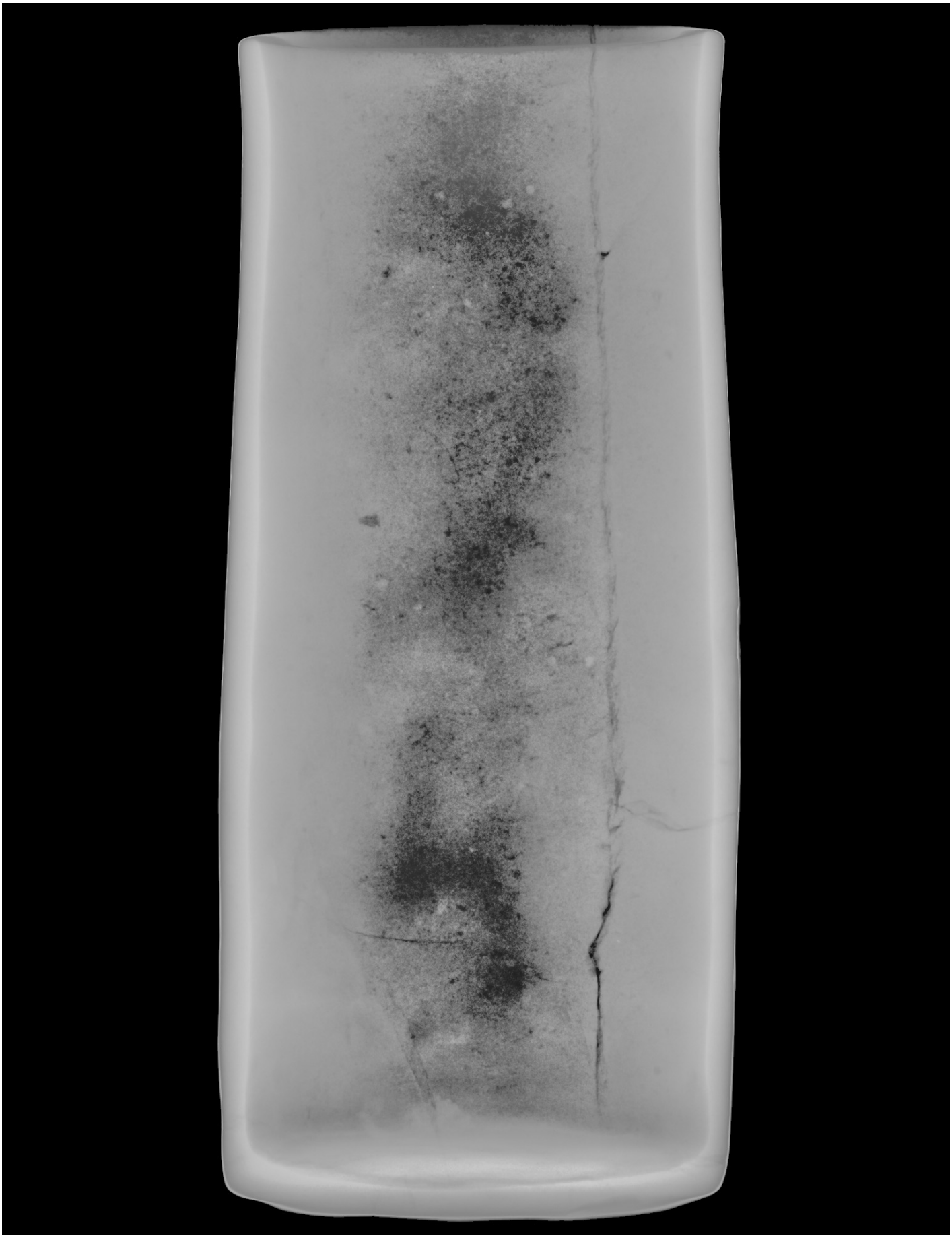
9
Ibid.; Marc Zender and Joel Skidmore, "Unearthing the Heavens: Classic Maya Murals and Astronomical Tables at Xultun, Guatemala," *Mesoweb* (website), 2012, http://www.mesoweb.com/reports/Xultun.pdf; Chinchilla Mazariegos, "In the Court of the Moon Gods: Maya Lunar Myths and the Patrons of Glyph C," in this volume.

Cat. 7

Studies of Manufacturing Techniques

X-Radiography

Radiographs reveal that this tall and slender vase has a virtually straight, vertical crack that extends from rim to floor. This indicates a construction of stacked rings of clay rather than a continuous spiral coil, the crack forming along the weakest part of the vessel wall where the ends of each ring meet. The potter incorporated a considerable amount of organic siccatives into the clay body, potentially to mitigate the natural stickiness of the clay. These left behind voids that register as small circular and rectangular black spots on the radiographs. The minute, evenly distributed light gray particles indicate the use of an inorganic temper, likely *sah kab* (marl). This particular combination of inclusions, both the organic siccatives and inorganic temper, as well as their distinctive distribution throughout the clay body, is similar to that of cat. 6, described above. This suggests that the potters prepared the clay for each vessel in a similar fashion.



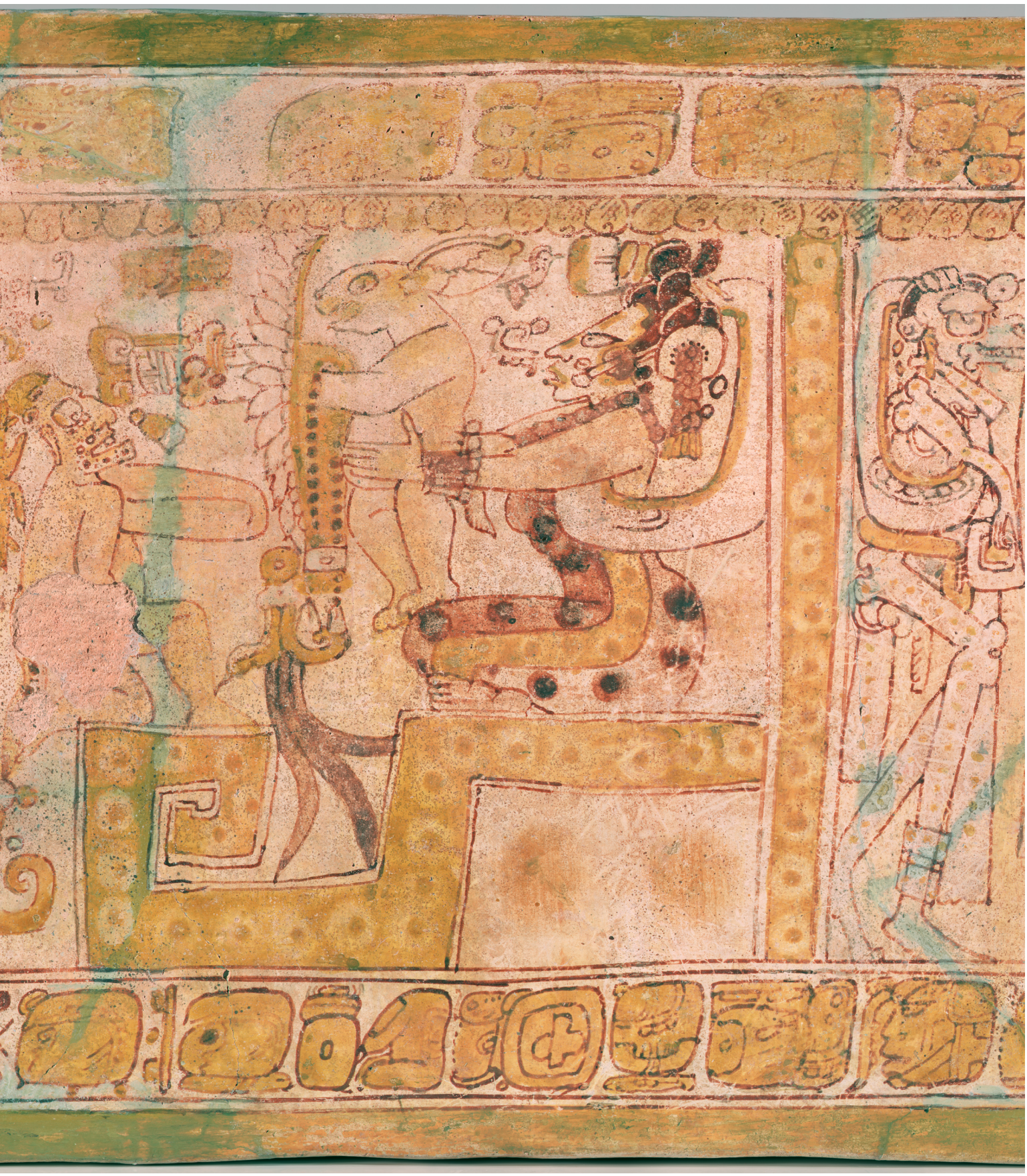
Rollout Photography

The artist selectively incorporated resist-painting techniques in order to create the different textures evident on this vase (fig. 3, left). Most colors were applied in two layers: a diluted base over which details were added with comparatively concentrated paint. Both techniques are apparent in the dress of the Moon Goddess, which has dark spots painted over a diluted black base, as well as light-colored circles executed with resist painting in red tones. The painter also experimented with clouds of diluted engobe.

FCIR Imaging

FCIR makes visible the application methods of varied engobe-based paints, particularly the dark panels of the Moon Goddess's dress, which were decorated with different concentrations of a black manganese-based engobe (fig. 3, right). The feathers in God L's headdress, held by the rabbit, were also painted with a black engobe, but with white clay added to create the gray color. The bluish-green lines pertain to a synthetic material used to adhere the vessel fragments in modern times.

Fig. 3
Side-by-side comparison of the same detail in visible reflected light and FCIR imaging. (Left) Detail of rollout photograph showing three different painting techniques: clouds of diluted color (on the throne), small circles of red resist painting (on the throne rim and the Moon Goddess's dress), and concentrated black spots over diluted engobe (on the Moon Goddess's dress). (Right) Same detail in FCIR highlights the two different concentrations of black pigment in the Moon Goddess's dress: The diluted black engobe appears red, likely indicating the use of manganese oxide, while the more concentrated circles remain opaque black.



Cat. 7

UVF Photography

Notably, this vase has very few root markings, which are easier to discern under ultraviolet light. Modern interventions appear in dark, opaque gray.

Cat. 8

Cylinder Vessel with Scene Related to Warfare and Offering

Naranjo or vicinity, Peten, Guatemala, 550–620 CE
Engobe-painted ceramic
Height: 8 1/4 in. (21 cm); diameter: 7 3/8 in. (18.6 cm)
Purchased with funds provided by Camilla Chandler Frost
M.2010.115.871
K7716

Painted on this vessel is a complex scene portraying a ruler of Naranjo, Guatemala, receiving warriors who are leaving for, or returning from, battle. The king sits in what may be a portable throne, and before him is a censer with burning rubber,[10] certainly an offering related to warfare. Indeed, stoking fire and burning tree resins and rubber were fundamental aspects of Maya ritual practice. Behind him is the hummingbird-jaguar palanquin of Naranjo.[11] Such palanquins would belong to a city and could be captured by an enemy polity, as happened with this very palanquin or another version of it.[12] In front are multiple standing and seated warriors holding banners or folding their arms in gestures of submission to the ruler. Eight of these warriors are partially overlapped and occluded, implying recession into space, as if they are standing in a flank.[13]

The inscription is a dedication text naming the chocolate-drinking vessel for a Naranjo ruler, Aj Numsaaj Chan K'inich (previously transcribed as Aj Wosal Chan K'inich).[14] This individual is also named on other chocolate vessels, including one in this book's study set (cat. 19).[15] The inscription identifies him as being in his second *k'atun* (twenty-year period), meaning he was between twenty and thirty-nine years old at the time the vessel was made.[16] He is also named as *chak ch'ok keleem* (great, strong youth).

This bowl, like others from the Tepeu I period (c. 550–700 CE) at Naranjo, is very light and has relatively thin walls.

10
Andrea J. Stone, "Spirals, Ropes, and Feathers: The Iconography of Rubber Balls in Mesoamerican Art," *Ancient Mesoamerica* 13, no. 1 (Spring 2002): 21–39.

11
Karl. A. Taube, "Ancient and Contemporary Maya Conceptions about Field and Forest," in *The Lowland Maya Area: Three Millennia at the Human-Wildland Interface*, eds. Arturo Gomez-Pompa, Michael F. Allen, Scott L. Fedick, and Juan J. Jimenez-Osornio (Binghamton, NY: Food Products Press, 2003), 461–92.

12
Martin, "Tikal's 'Star War' Against Naranjo," in *Eighth Palenque Round Table, 1993*, eds. Martha J. Macri and Jan McHargue (San Francisco: Pre-Columbian Art Research Institute, 1996), 223–36.; Taube, "Ancient and Contemporary Maya Conceptions about Field and Forest," 487.

13
Michael D. Coe, "Art and Illusion among the Classic Maya," *Record of the Art Museum, Princeton University* 64 (2005): 52–62.

14
Martin and Dmitri Beliaev, "K'ahk' Ti' Ch'ich': A New Snake King from the Early Classic Period," *The PARI Journal* 17, no. 3 (Winter 2017): 1–7.

15
Houston, "A Splendid Predicament: Young Men in Classic Maya Society," *Cambridge Archaeological Journal* 19, no. 2 (June 2009): 149–78.

16
Houston and Alexandre Tokovinine, "Caracol at Cambridge," *Maya Decipherment: Ideas on Ancient Maya Writing and Iconography* (blog), Sept. 12, 2016, https://decipherment.wordpress.com/2016/09/12/caracol-at-cambridge/.

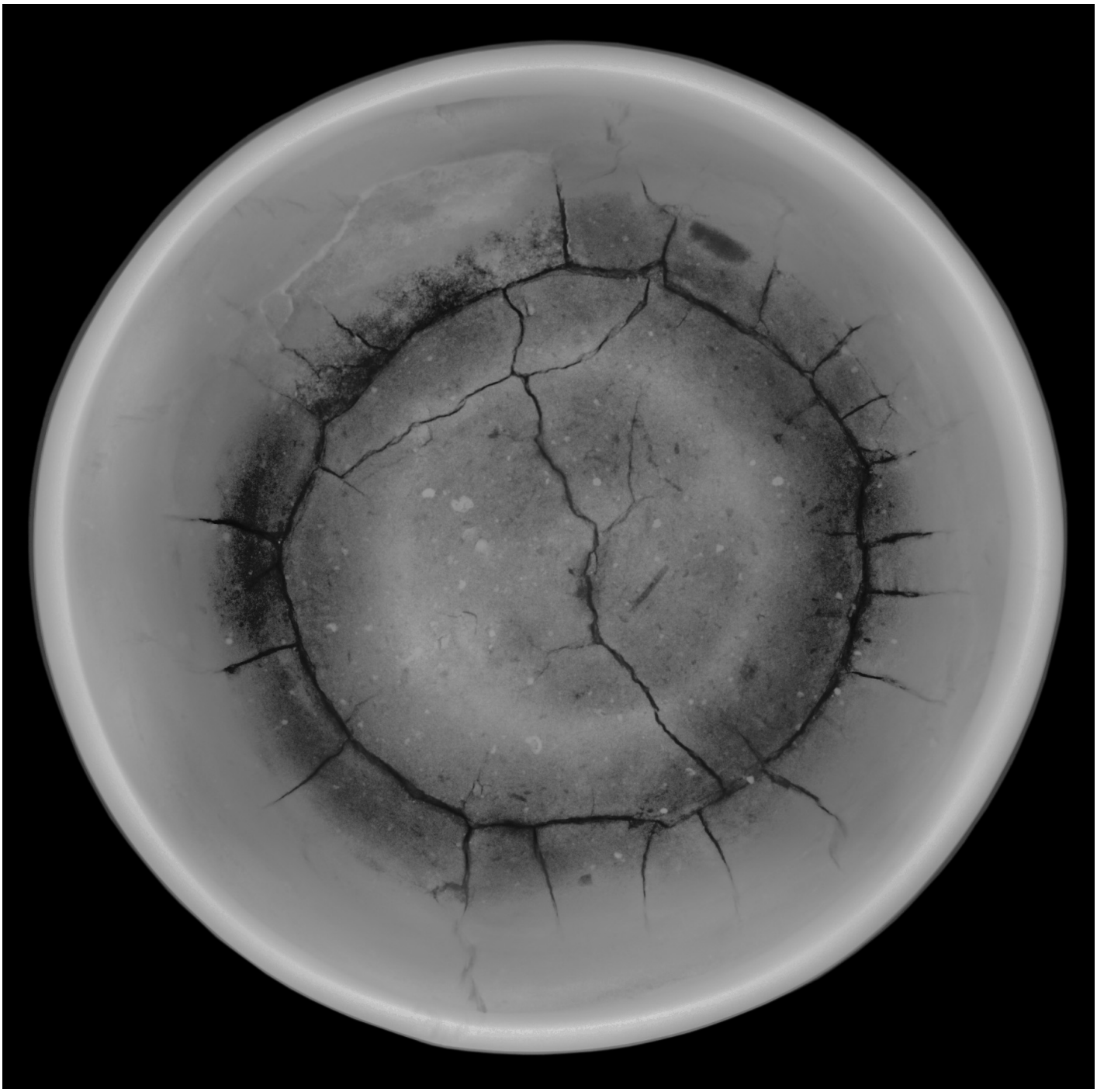
X-Radiography

Using radiographs of the vessel floor, it is possible to see that the potter fashioned the base with a flattened circular disk and then added coils to build up the walls; a distinct crack has formed at this juncture. Once coiled, the vessel walls were thinned by scraping with a rib (a tool used in ceramic production to smooth clay walls) (see Hirx and O'Neil, this volume). Organic siccatives appear as minute circular voids in the clay body. Unlike other vessels in which inorganic temper appears as points of bright, opaque white, here the contrast in particles is not strong, which perhaps indicates the use of a material that is closer in chemistry to and/or has a similar radiodensity as the clay body, such as grog (see Hirx and O'Neil, this volume). Another potential candidate for this material is *nooy*, the most refined temper used by present-day Yucatec Maya potters in Ticul, Mexico.[17] *Nooy* consists of a mixture of fine *sah kab* (marl) and *sak lu'um* (palygorskite), the special clay used to fabricate Maya blue (see catalogue Group 3, "Exemplars of Postfire Stucco Painting," for more on this pigment). The deposits mined for temper sometimes contain a combination of both materials, with *sak lu'um* always occurring on top of *sah kab*.[18]

17
Dean E. Arnold, *Maya Potters' Indigenous Knowledge: Cognition, Engagement, and Practice* (Boulder, CO: University Press of Colorado, 2018), 96–101.

18
Arnold, *Maya Potters' Indigenous Knowledge*, 72–75.

Cat. 8



Rollout Photography and FCIR Imaging

The vessel was painted in a traditional manner, with an initial application of a white primer layer to prepare the surface of the clay for painting. On top of this base, the artist painted a translucent orange engobe to serve as the background color, and then traced the figures and glyphs with a black outline. Next, each figure was painted with a narrow range of colored engobes. The most predominant is an opaque red engobe that colors the painted skin of the warriors as well as the feathers in their headdresses and battle standards (fig. 4, left). The black engobe was used in a concentrated formulation to paint the black detailing, and was diluted and mixed with white clay to paint the gray tones. Notably, both the red and black engobes exhibit a crackled pattern in their concentrated formulations, suggesting the probable use of the same engobe base with different mineral colorants. In FCIR imaging (fig 4, right), the black and gray tones reflect as reddish brown, signaling the use of a manganese-based colorant. The faint greenish-blue lines identify areas of modern restoration.

Fig. 4
Side-by-side comparison of the same detail in visible reflected light and FCIR imaging: (left) highlighting the use of red, black, and grey engobes; (right) FCIR detail showing the reddish hue of the black and gray engobes, which likely identifies the colorant as manganese based. The greenish-blue line across the image indicates modern restoration with a synthetic material (e.g., a binder, consolidant, or glue). All of the red iron-based pigments are seen in different hues of yellow.

Cat. 8

Cat. 8

Cat. 9

Cylinder Vessel with Scene of Supernatural Marriage Rituals

Peten, Guatemala, 600–900 CE
Engobe-painted ceramic
Height: 9 3/4 in. (24.9 cm); diameter: 4 1/2 in. (11.4 cm)
Purchased with funds provided by Camilla Chandler Frost
M.2010.115.585
K5847

The mythological scene on this cylinder vessel portrays the transport of women to an aged god in an underworld location; it may be a mythological model for weddings.[19] On one side, an aged deity with jaguar attributes is enthroned in a cave; he sits on a bone throne on top of a personified stone and within a leafed arbor. Facing him are two registers with figures: The upper depicts three seated males wearing broad-brimmed traveling hats and facing the aged god; the lower portrays a male in front of a kneeling young woman holding a bundle. Wrapping around the other side of the vessel, two men use tumplines to carry women wearing traveling hats; next to them (and closer to the aged god) is a standing woman. These women appear to have been carried to this location, perhaps for their marriage to this aged deity.

The vertical text on a painted pillar is composed of a lengthy inscription that includes dates and events—including a *lok'ooy* (departure) event—and is comparable to a vessel in the collection of the Museo Popol Vuh in Guatemala. Small inscriptions next to the figures name them: One of the females being carried is named Lady Dark Sun, and another is Ix Ook Ahiin (Lady Crocodile Foot).[20] The dedication text encircling the rim names it as a vessel for chocolate for an individual named as a *chak ch'ok keleem* (great, strong youth). Stephen Houston has discussed such references to youths on Late Classic (600–800 CE) Maya vessels and concludes that they relate to a phenomenon of gifting polychrome vessels to elite young men, perhaps as part of age-grade rituals.[21]

19
Houston, David Stuart, and Taube, *The Memory of Bones: Body, Being, and Experience among the Classic Maya* (Austin: University of Texas Press, 2006), 43–45.

20
Luís Lopes, "A New Look at the Name Phrase of the 'Snake Lady,'" *Wayeb Notes* 19 (2005), http://www.wayeb.org/notes/wayeb_notes0019.pdf, 5–7.

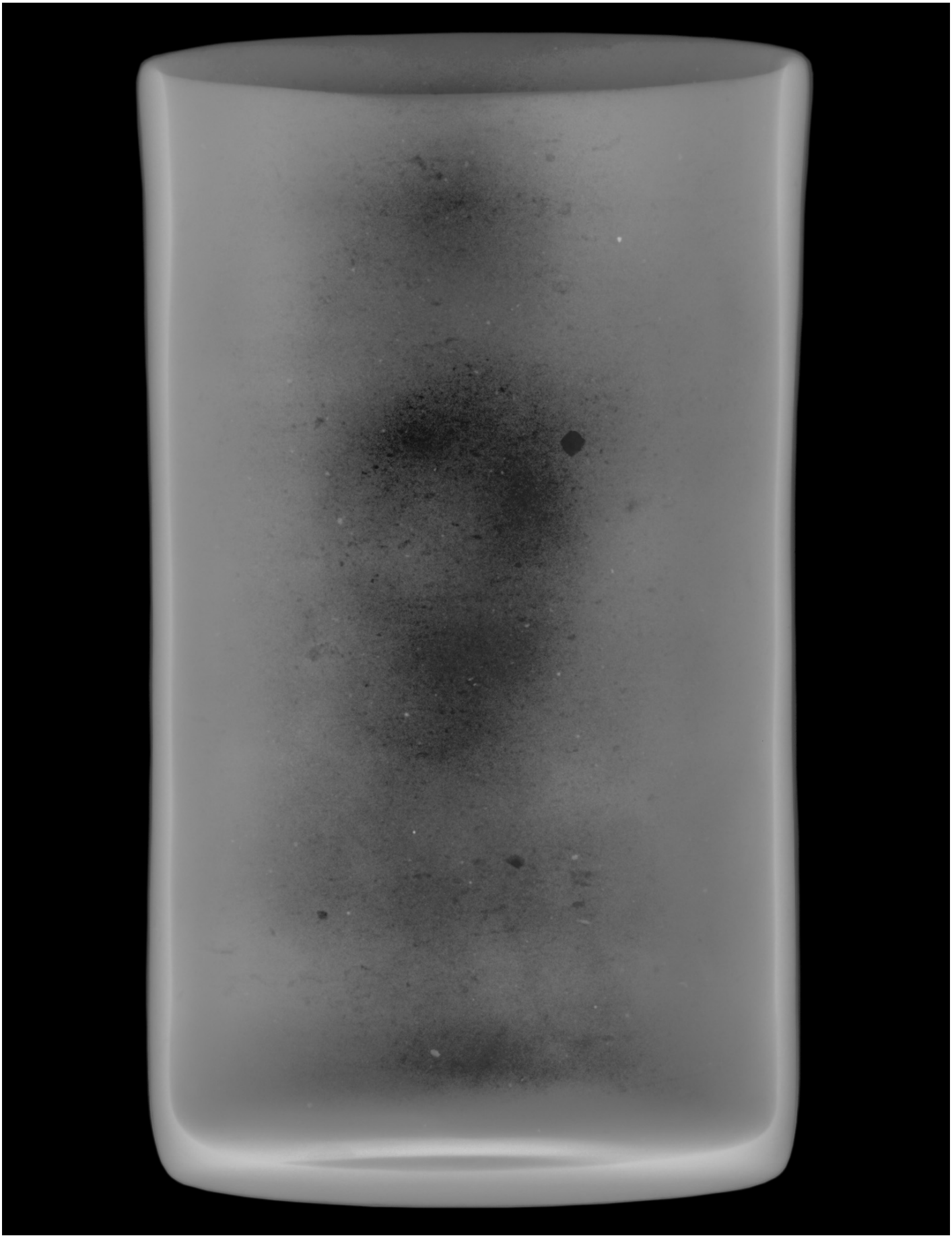
21
Houston, "A Splendid Predicament"; Houston, *The Gifted Passage: Young Men in Classic Maya Art and Text* (New Haven, CT: Yale University Press, 2009), 60; see also, Houston, "The Social Life of Maya Pots," this volume.

Cat. 9

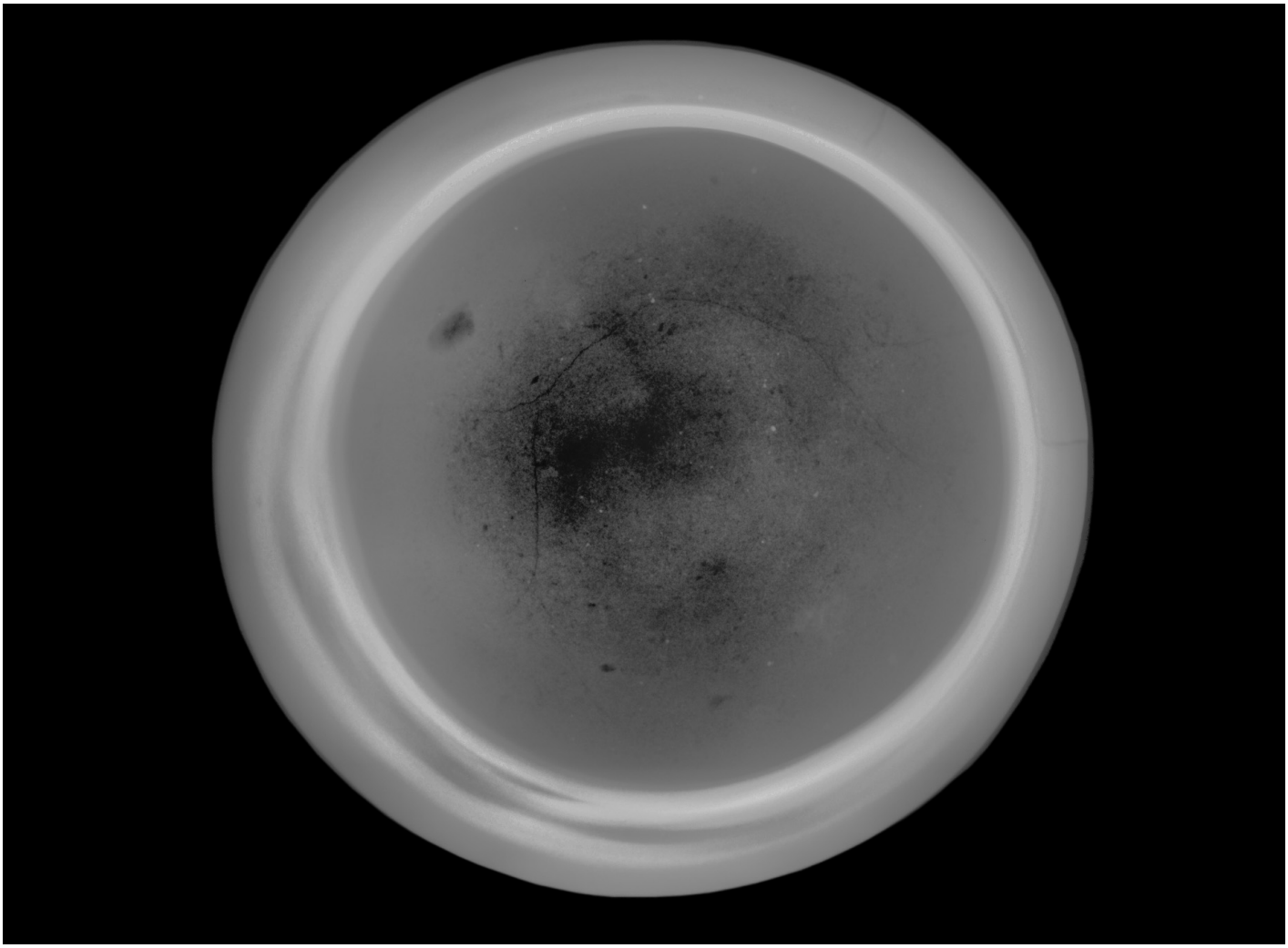
Studies of Manufacturing Techniques

X-Radiography

The radiograph of the floor of the vessel shows a diagnostic curved crack, indicative of inadequate joining of coils before the vessel was fired. The radiograph of the walls of the vessel reveals many diminutive dark spots, which pertain to the voids left by burned-out organic siccatives, possibly seeds. Furthermore, small holes once occupied by seeds pock the surface of the vessel. The clay body contains minimal visible inorganic temper, suggesting the use of a material with similar radiopacity to the clay body, such as *nooy* (see cat. 8).



Cat. 9



Rollout Photography

This vessel exhibits a vivid scene with a basic palette, and it demonstrates a distinctive methodology of working with colored engobes. The primer layer, usually a white clay, is in this case an orange-tinted buff color. The figures were drafted with a black outline, and the same orange-buff engobe of the background color was used to paint their skin. The artist, however, evoked volume and depth by employing diluted engobes to create areas of shade. Accents of colored engobes—primarily red, black, and white—enhance the composition. For the last step, the painter applied another layer of white engobe over the background, probably to produce a higher contrast with the figural scene. Unfortunately, most of this outermost white layer has been lost, likely due to the engobe formulation lacking sufficient flux (fig. 5). The resulting ceramic paint would have had a higher melting point, preventing it from bonding adequately to the base layer.

FCIR Imaging

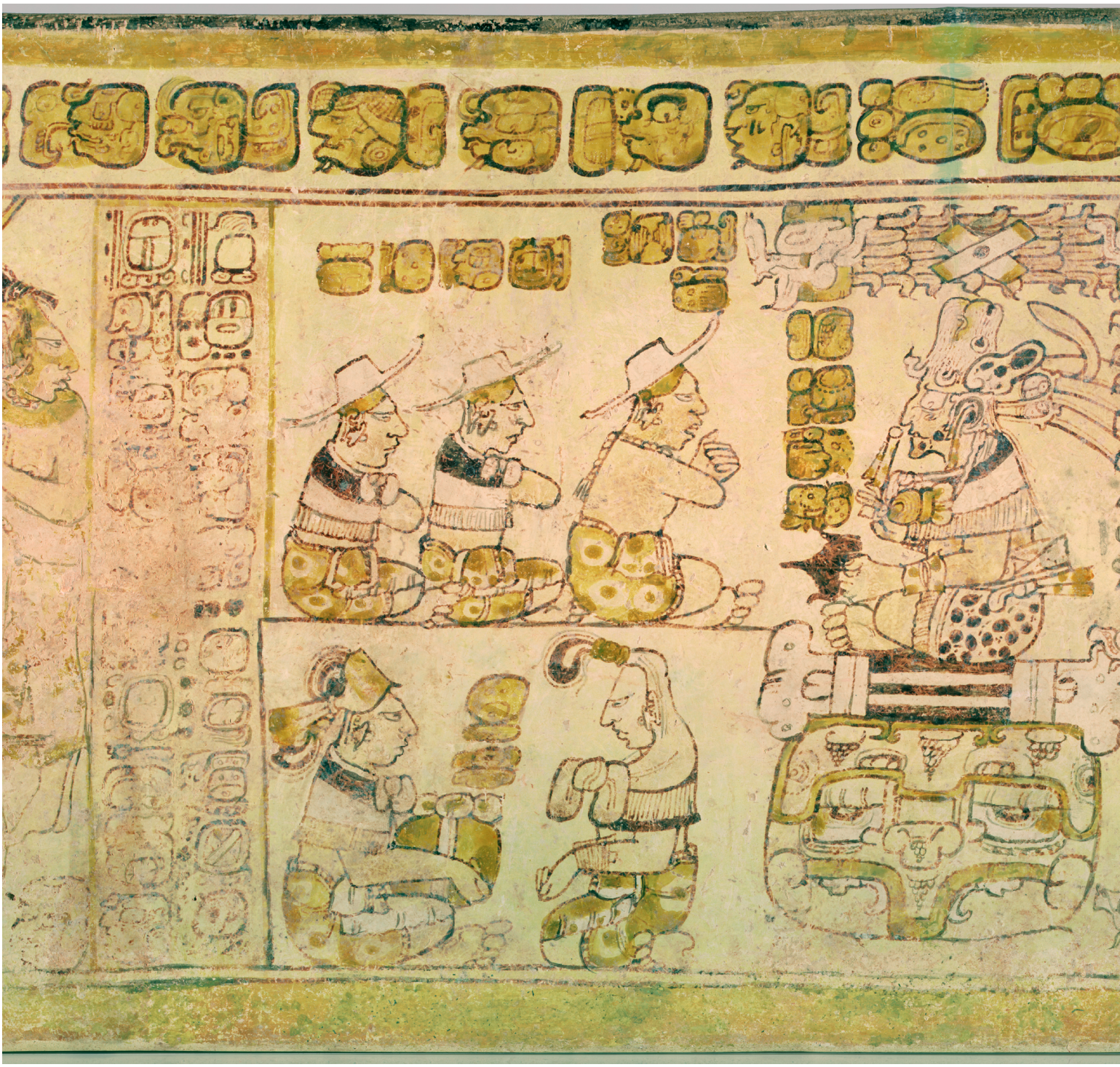
Areas where the outermost layers of engobe have been lost due to abrasion acquire a pink hue in the FCIR image. The outlines were likely drafted using a manganese-based engobe, which reflects reddish brown (fig. 6). The few areas with modern repaint and repair show in greenish blue and black. The red iron pigment appears in dark yellow, while the light yellow in the background shows the light orange engobe covered with a thin layer of white.

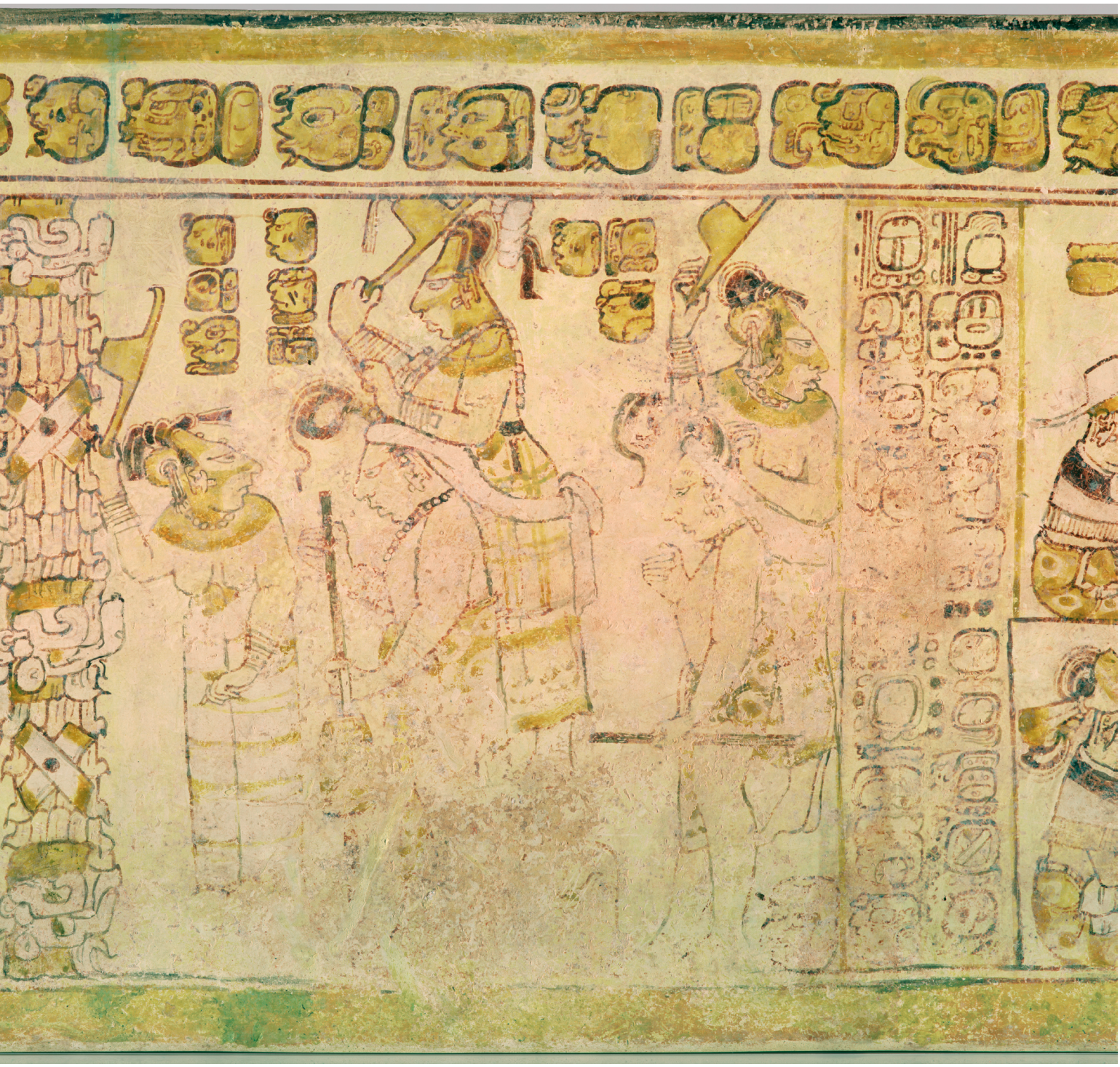
Fig. 5
Detail showing the wear of the outermost white engobe, as well as the shading techniques evident in the face and body paint

Fig. 6
Detail of FCIR image showing the original black lines (reddish-brown hue) and areas of modern restoration (greenish black)

Cat. 9

Cat. 9





Cat. 10

Squared Vessel (Vase of the Eleven Gods)

Naranjo or vicinity, Peten, Guatemala, c. 755–780 CE
Engobe-painted ceramic with postfire stucco
Dimensions: $9^{5}/_{8} \times 6^{1}/_{2} \times 6^{3}/_{8}$ in. (24.5 × 16.5 × 16.2 cm)
Anonymous gift
M.2010.115.14
K7750

This squared vessel takes the form of an ideal palace or temple that also emulates the cosmos. In the painted scene, ten deities with solar and avian attributes face the cigar-smoking God L, an underworld deity and merchant god, who sits on a throne covered with a jaguar pelt inside a mountain or cave.[22] Behind him, a bundle, perhaps brought to him as an offering, is labeled *i-kaatz* (tribute or jewelry), referring to wealth.[23] The inscription provides the date 4 Ajaw 8 Kumk'u and the verb *tz'ahkaj* (it was put in order), which refers to the ordering of the gods pictured on the vessel.[24] It is the start of a new cycle of time, when the world is created or renewed.

The dedication text, painted below the rim, names it as a drinking vessel for chocolate, although its shape suggests it was not for drinking. The name of the patron or owner is K'ahk' Ukalaw Chan Chahk, lord of Sa'aal, a kingdom centered at Naranjo, Guatemala.[25] There also is a signature of the scribe who painted the vessel. The scene is analogous to a cylindrical vessel, K2796 (currently an anonymous loan to the Art Institute of Chicago), which portrays seven deities ordered for this important occasion.

22
Mary Ellen Miller and Martin, *Courtly Art of the Ancient Maya*, exh. cat. (San Francisco: Fine Arts Museums of San Francisco; New York: Thames & Hudson, 2004), 58–63.

23
Tokovinine and Beliaev, "People of the Road: Trade and Travelers in Ancient Maya Words and Images," in *Merchants, Markets, and Exchange in the Pre-Columbian World*, eds. Joanne Pillsbury and Kenneth G. Hirth (Washington, D.C.: Dumbarton Oaks Research Library and Collection, 2013), 169–200.

24
Grube and Justin Kerr, "Two Sides of a Quadrangular Polychrome Classic Maya Vase," *Mexicon* 20, no. 1 (February 1998): 1–2.

25
Tokovinine, "Proyecto Arqueológico Holmul: Reporte Epigráfico de la Temporada de 2005," in *Investigaciones Arqueologicas en la Region de Holmul, Peten, Guatemala. Informe Preliminar de La Temporada 2005*, ed. Francisco Estrada-Belli (Nashville: Vanderbilt University, 2005), 347–67; Tokovinine, "The Power of Place: Political Landscape and Identity in Classic Maya Inscriptions, Imagery, and Architecture," PhD diss. (Harvard University, 2008), 138.

Cat. 10

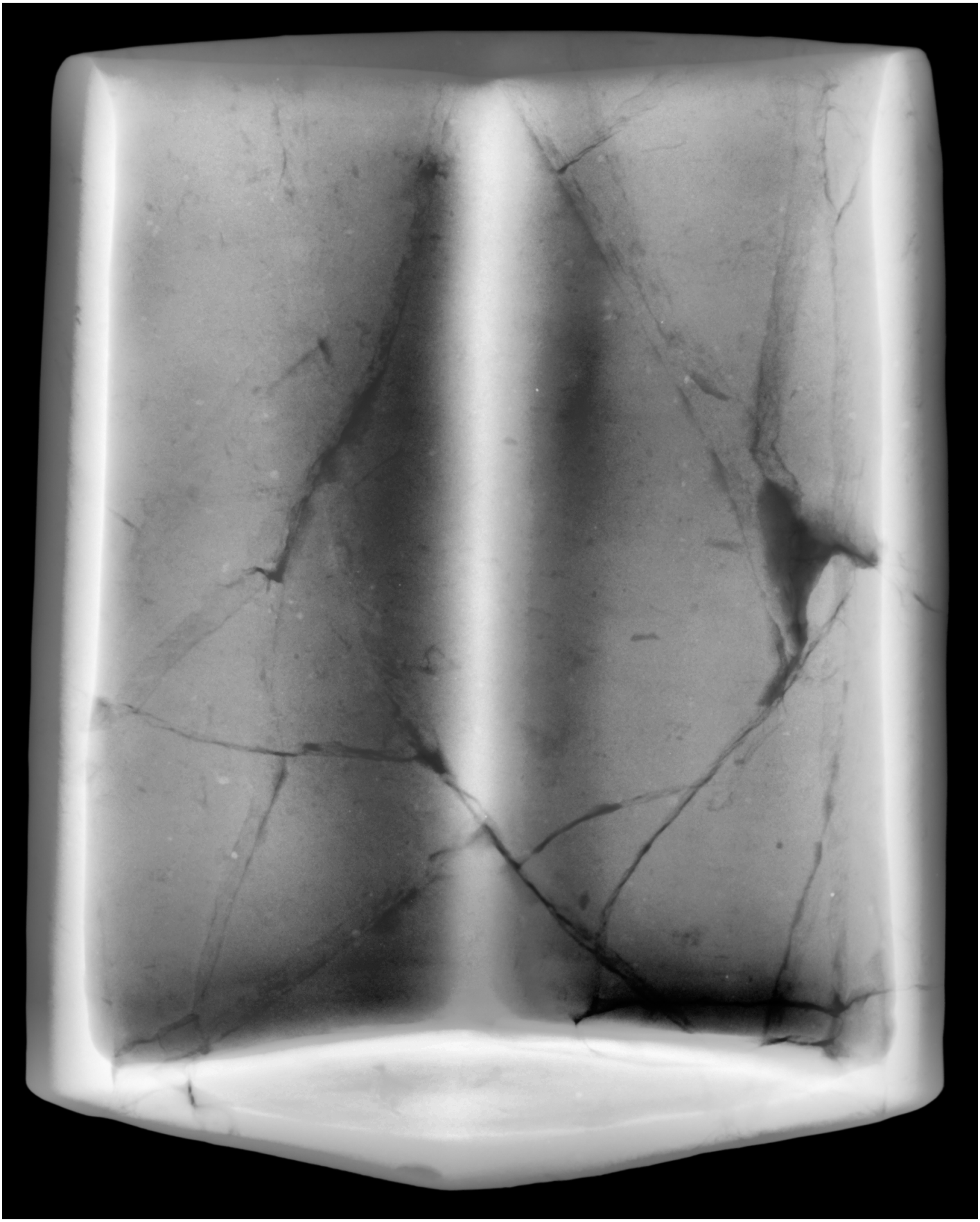
Cat. 10

Cat. 10

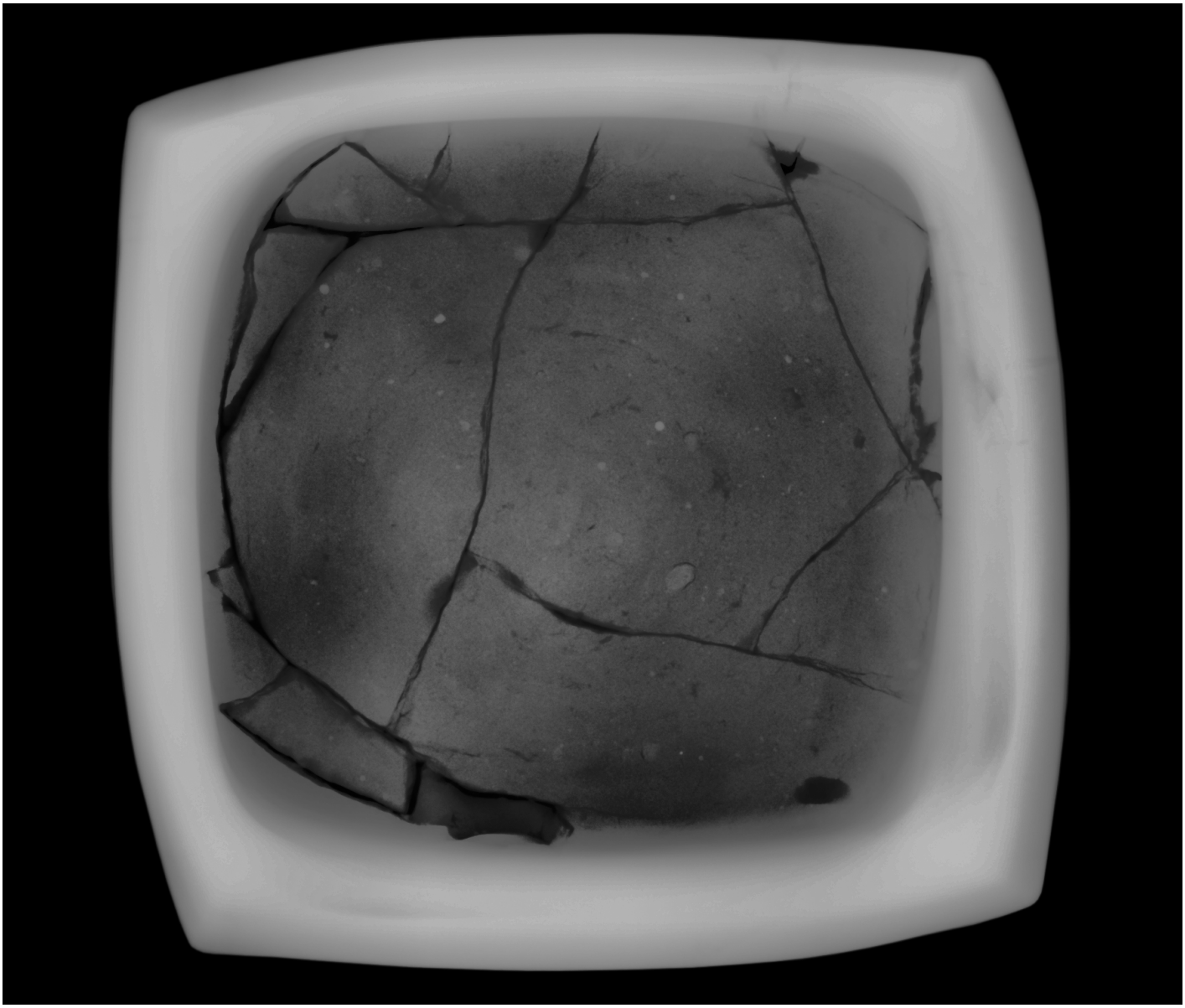
Studies of Manufacturing Techniques

X-Radiography

Radiographs reveal the manufacturing technique used to make this rare squared vessel. The image of the floor shows that the artist first formed a coiled disk, flattened it, and then cut a square from it. Dark gray ovoid impressions pertain to finger marks from the flattening and thinning process. The potter then used a continuous spiral coil to form the vessel walls in a roughly square shape, subsequently using the paddle-and-anvil technique to adjust the walls and corners. This technique involves an anvil to support the inside of the vessel, while a flat paddle hits the outside to flatten the walls. For this vessel, the interior corners remain rounded, while the outside has been refined with sharper angles. The direction of the coiling, moving from left to right, can be discerned in the radiograph. There is no visible use of inorganic temper such as *sah kab* in the clay body (which would appear as evenly distributed bright white specks in the radiograph), but this does not preclude the use of fine-temper *nooy* or grog, which has the same radiopacity as the clay body (see cat. 8).



Cat. 10



Visible Reflected Light Photography

The artist first covered the flat exterior walls with a white engobe primer, still visible along the rim of the vessel, which is a standard step in the painting process for most Maya vessels. The fact that the interior walls were left unslipped, together with the flatness, format, and dimensions of the exterior walls, suggest the ceramic artist sought to reference the pages of a painted screen-fold book. The figures also were painted in a style consistent with Maya manuscript painting—drafted and detailed in black lines with a fine brush. The fluid lines imbue the figures with energy and movement. Once the scene had been drafted, translucent engobes were applied in thin, overlapping layers to create a range of colors from a limited palette. God L, whose throne, body, and cape were all colored with different layering sequences of orange-red engobe with black detailing, provides an illustrative example (fig. 7). In some areas, such as his arms and belly, a light orange base was covered with a thin layer of black engobe, creating a darker shade or tone. This technique is similar to that used in manuscript painting; the ceramic layers, as much as the organic lacquers in manuscripts, refract incoming and exiting light, creating vibrant colors. After these figures were drafted, colored, and detailed, the artist painted the black and red backgrounds in thick consecutive layers to create a completely saturated effect. This also caused the engobe to crack as it dried, a now readily apparent characteristic.

Fig. 7
Detail of God L highlighting the range of colors created with a limited palette

FCIR Imaging

The materials used to repaint and integrate the glued joints of fragments shift to a greenish-blue hue in FCIR. These images highlight the use of the same colored engobes of other vessels, the reddish brown indicating manganese-based engobes, and the yellow tonalities suggesting iron-rich engobes.

Cat. 10

Cat. 10

Cat. 11

Squared Vase with Supernatural Birth Scenes

Northern Peten, Guatemala, or southern Campeche, Mexico, 650–750 CE
Engobe-painted ceramic
Dimensions: 10 × 4¹/₄ × 4¹/₄ in. (25.4 × 10.8 × 10.8 cm)
Purchased with funds provided by Camilla Chandler Frost
M.2010.115.452
K5113

This heavily broken and eroded square vessel bears extraordinary paintings illustrating scenes of supernatural birth and deities performing offerings related to birth; and its text mentions mythological birth.[26] Karl A. Taube suggests it once had a lid shaped like a roof in order to make the vessel into a four-sided house.[27] The four sides are also analogous to pages of a screen-fold codex on which different parts of a narrative are rendered. Although the reading order could have varied, scholars have assigned roman numerals to the sides to distinguish the scenes. One scene, side I, portrays a young goddess and at least two old goddesses, including Chak Chel or Ix Chel, a midwife and goddess of curing and childbirth. Their youth or old age is depicted both in their faces and in the rendering of their breasts, either full and round or flattened and pendulous.[28] The young woman holds onto a twisted serpent rope used for support during childbirth and evocative of a supernatural portal.[29] Side II portrays two old goddesses and an anthropomorphic figure emerging from a supernatural serpent maw, conjured during rituals related to birth.[30] The scene painted on side III presents another old goddess and a supernatural serpent with jaguar features. Side IV includes two offering scenes: one with the young goddess holding a bowl containing sacrificial items and facing an old man, likely a Pawatun, and three more Pawatuns facing a burning censer.[31] The images illustrate details relating to actual Maya birth practices, providing insight into crucial activities that are not typically shown on polychrome ceramics.[32]

26
Taube, "The Birth Vase: Natal Imagery in Ancient Maya Myth and Ritual," in *The Maya Vase Book: A Corpus of Rollout Photographs of Maya Vases*, vol. 4, eds. Barbara Kerr and Justin Kerr (New York: Kerr Associates, 1994), 652–85.

27
Ibid., 652.

28
Stone, "Keeping Abreast of the Maya: A Study of the Female Body in Maya Art," *Ancient Mesoamerica* 22, no. 1 (Spring 2011): 167–83, https://doi.org/10.1017/S0956536111000137.

29
Taube, "The Birth Vase," 657–60.

30
Ibid., 663–64.

31
Ibid., 667–68.

32
Ibid., 656.

Cat. 11

Side III

Side I

Side II

Side IV

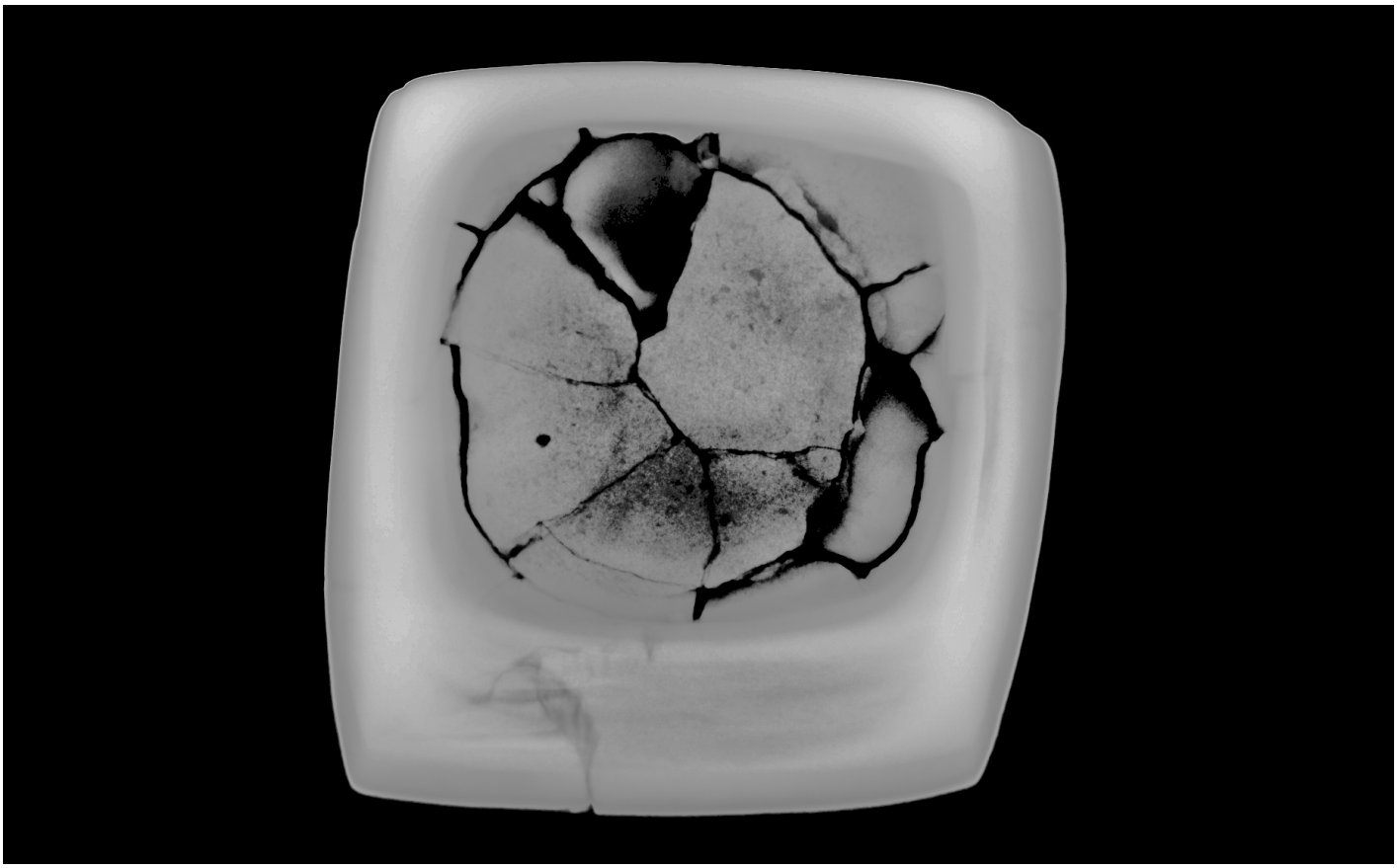
Cat. 11

Studies of Manufacturing Techniques

X-Radiography

This vessel has been reconstructed from multiple sherds, which fortunately are all original. The manufacturing technique is evident in the image of the floor, which exhibits a circular crack pattern indicative of the coiling process. The walls appear tilted and decentered, suggesting that the vessel was squared with the paddle-and-anvil technique while the clay was still fairly wet (for more on the paddle-and-anvil technique, see cat. 10). This square pot is relatively narrow compared to the *Vase of the Eleven Gods* (cat. 10), thus it would have been more difficult to control its shaping.

Cat. 11



Visible Reflected Light Photography

Large areas of surface loss are due to the conditions of the burial environment (see fig. 8); these areas of exfoliation reveal the layering sequence of the composition. As is typical of Maya vase painting, the first layer of engobe was white, seemingly working as an *imprimatura* or primer to seal the porous clay body and provide a light base color for painting, imparting a vibrancy to the thin layers of colored engobes. In this case, the second step entailed the application of a light orange or buff-colored engobe as the ground for painting. Then, the figures were traced and colored.

Fig. 8
Detail of the eroded surface, which reveals the white primer layer underneath the thin orange engobe used for the background color

FCIR Imaging

Although pXRF spectroscopy was not performed on this vessel, FCIR imaging indicates that the black pigment is manganese-based, the firm, dark lines reflecting the telltale reddish-brown hue. Areas of modern repair appear as streaks of blue-green, likely resulting from a modern adhesive. Due to the conditions of the burial environment, a black patina, which looks reddish in FCIR, formed on some of the fragments.

Cat. 11

Group 3

Exemplars of Postfire Stucco Painting

Cat. 12

Tripod Cylinder Vessel in Teotihuacan Style

Peten, Guatemala, late 4th–early 5th century CE
Slipped ceramic with stucco and postfire pigment
Height: 9 in. (22.9 cm); diameter: 9½ in. (24.1 cm)
Anonymous gift
M.2010.115.1066a–b
K7529

This lidded vessel (along with two others that may have been painted at the same time: cats. 13 and 14) is a prime example of artistic connections between Maya cities of the Peten and the great Central Mexican metropolis of Teotihuacan. These artistic connections likely resulted from late-fourth-century political contacts that appear to have involved conquest and regime change. Maya artists emulated the Teotihuacan practice of painting vibrant colors onto stucco on tripod cylinders, but they also experimented with form, color, and technique. For example, Maya artists added lids with human heads that anthropomorphize the vessels; the heads on these vessels are hollow and seem to have been mold-made with added elements, similar to the manufacture of Maya figurines.

This vessel has an inscription rendered across the cartouches of the cylinder and lid dedicating the drinking vessel for *kakaw* (chocolate). The glyph in the cartouche before the *kakaw* glyph bears distinct red pigments in its upper and lower sections, indicating it was painted in two episodes.[1] The meaning of this glyph remains a matter of debate—it reads *sa'* and refers either to Naranjo, Guatemala, identifying the place from which the cacao originated, or to cacao mixed with maize gruel; the latter reading appears to be more likely, as discussed in Reents-Budet and Bishop, "Pottery of the Central and Eastern Peten," this volume.[2]

1 See Maccarelli et al., "Postfire Painting," in this volume.

2 David Stuart et al., "Glyphs on Pots: Decoding Classic Maya Ceramics," in *Sourcebook for the 29th Maya Meetings at Texas, the University of Texas at Austin*, ed. Stuart (Austin: University of Texas at Austin, 2005), 28; Stuart, "The Language of Chocolate: References to Cacao on Classic Maya Drinking Vessels," in *Chocolate in Mesoamerica: A Cultural History of Cacao*, ed. Cameron L. McNeil (Gainesville, FL: University Press of Florida, 2006), 184–201; Alexandre Tokovinine and Vilma Fialko, "Stela 45 of Naranjo and the Early Classic Lords of Sa'aal," *The PARI Journal* 7, no. 4 (Spring 2007): 1–14; Kerry Hull, "An Epigraphic Analysis of Classic-Period Maya Foodstuffs," in *Pre-Columbian Foodways: Interdisciplinary Approaches to Food, Culture, and Markets in Ancient Mesoamerica*, eds. John E. Staller and Michael Carrasco (New York: Springer, 2010), 235–55.

Cat. 12

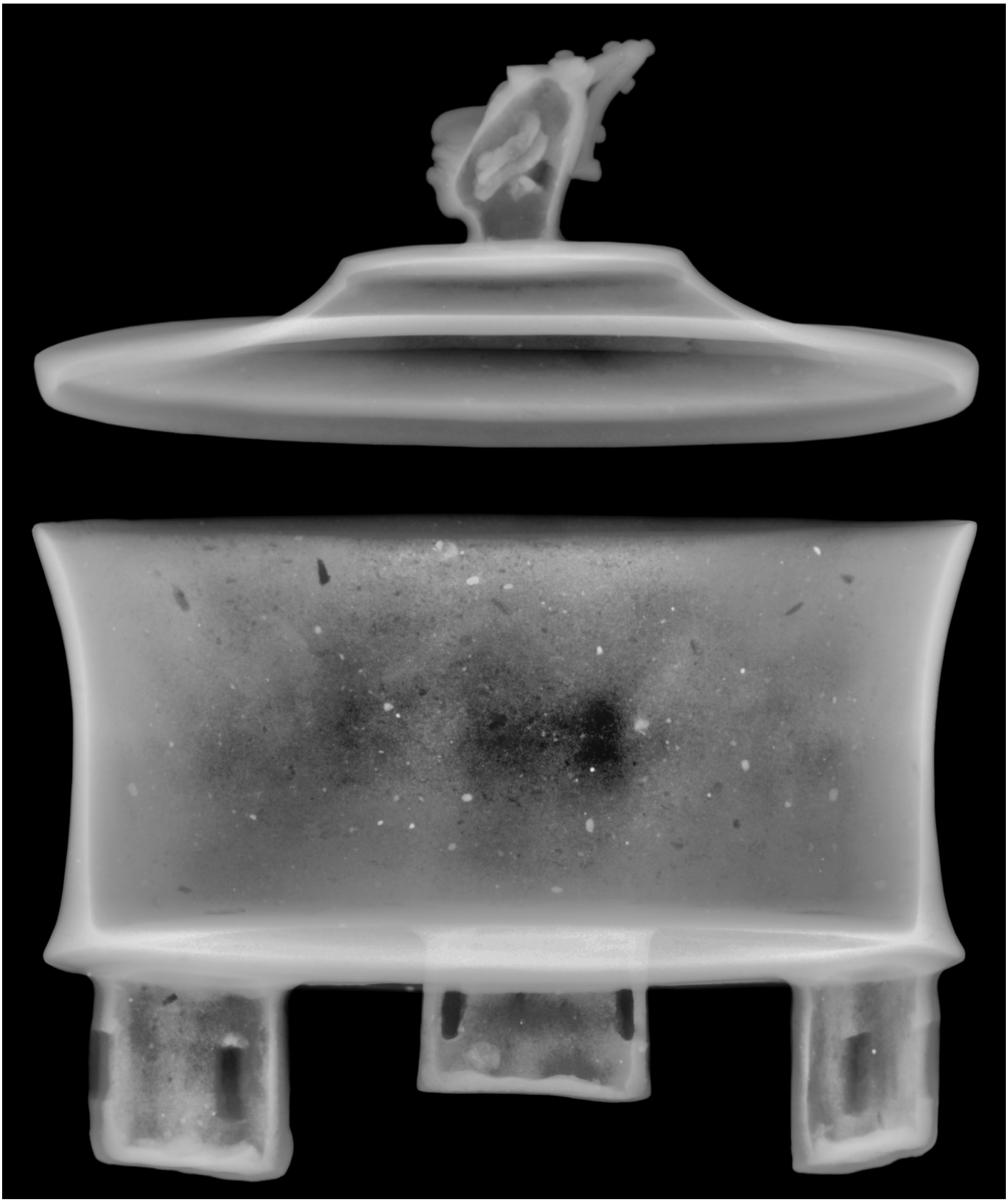
Studies of Manufacturing Techniques

X-Radiography

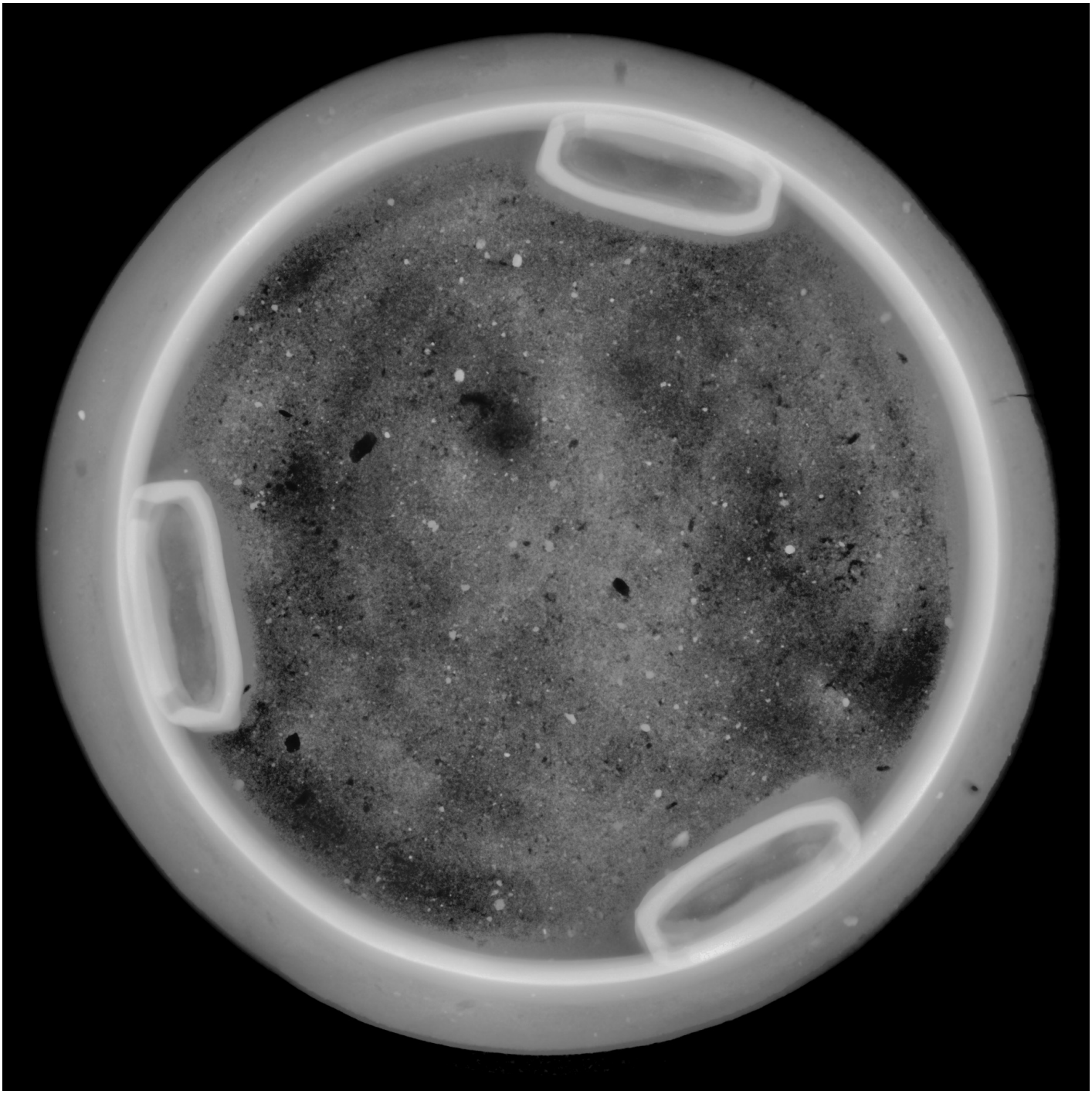
The radiograph shows a well-formulated clay body that facilitated the construction of remarkably thin and even walls. The inorganic temper is composed of evenly distributed small gray particles, likely marl (*sah kab*), as well as some levigated sand, visible as rounded white spots of various sizes. When potters formulate a clay body, they add specific proportions of temper to make the clay workable and to increase the probability of successful firing. In this case, marl was the principal additive, with sand accounting for roughly three percent. There are also a few elongated black voids apparent on the image, which pertain to organic siccatives that burned out in the firing process. The same defining characteristics are visible in another vessel (cat. 13), indicating that the set was manufactured from the same clay source and recipe.[3]

The assessment of x-radiography in this manner allows for the confirmation of proposed ceramic groupings based on visual examination.

3 See Reents-Budet and Bishop, "Pottery of the Central and Eastern Peten," in this volume.



Cat. 12



Rollout Photography

This stucco-painted Maya tripod vessel with three roundels exhibits damage to the stucco layer. The center roundel is divided into two sections of different coloration. The top portion, with a redder hue, pertains to an earlier painting campaign that later was covered by a second layer of stucco, the bottom portion, which replicated the original design. Because a large section of the painted surface is missing, the burnished body of the ceramic is visible, confirming that the artist prepared the vessel for stucco application by smoothing its surface. A band of light blue-green pigment, which is further discussed below, can be observed along the base. The three pillow-like supports bear slits that functioned as firing vents. The vessel is accompanied by a human-headed lid bearing three painted cartouches.

FCIR Imaging

In FCIR, both red pigments have a yellow hue. The mixture of clay and stucco that adorns the exterior surface of the vessel acquires a pink hue, while the greenish-blue areas pertain to instances of modern repaint. The bands of light blue-green pigment at the base of the vessel and encircling the lid's rim acquire a sky-blue tone. This pigment was identified through pXRF and SEM/EDS as containing copper, and thus is a mineral related to malachite. The famed Maya blue pigment is an artificial color made by dyeing palygorskite clay with indigo, which acquires a pink hue in FCIR, suggesting that at this point in the Early Classic period (250–600 CE), Maya blue was not yet in common usage, as it would later become in the Late Classic period (600–800 CE).

Cat. 12

Cat. 12

Material Analysis

Portable XRF was performed on different regions of the vase (fig. 1). Both mercury and iron were detected in the deep red of the central cartouche (point XRF11), suggesting the use of cinnabar and ocher. The lighter, pink region (point XRF12) contains mainly mercury (cinnabar). Aluminum, silicon, and calcium were detected in all spots analyzed; these likely pertain to calcite and an aluminum-silicate clay comprising the stucco surface.

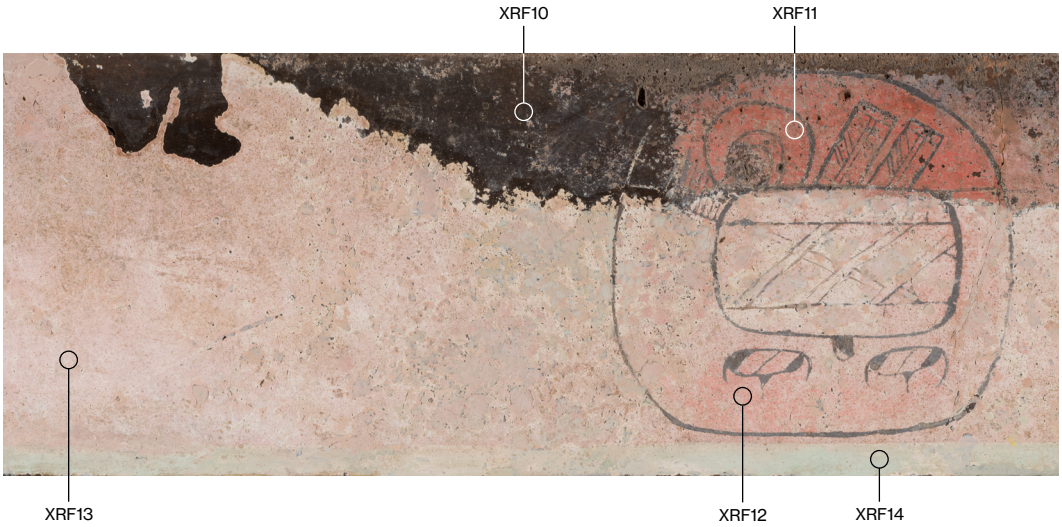


Fig. 1
Rollout photograph marking locations analyzed with pXRF spectroscopy

Samples were taken from the two painting campaigns evident in the central roundel: the first red campaign (top) and the second, lighter, pink campaign (bottom). Visual examination of the micrographs of the darker red region reveal two layers: a compact base underneath a layer speckled with dark red particles pertaining to cinnabar (fig. 2a). The micrograph of the cross section from the lighter, pink region shows a similar compact base layer, but with a mix of white and red particles on top (fig. 4a). Comparison of the two micrographs exhibits differences in the stratigraphy of the samples, inferring that the two campaigns were completed at different times.

SEM micrographs of the two cross sections also reveal differences between the two regions, particularly in the size of the particles that comprise the ground layer and pigments (figs. 2b and 4b). The homogenous appearance of the substrate of the red sample indicates the use of clay without any lime aggregates; the coarse appearance of the substrate of the pink sample, by contrast, points out that the stucco was prepared with both lime and clay. EDS elemental mapping further clarifies the material structure of the stucco and overlaying pigments (figs. 3 and 5). The even distribution of silicon (Si) and aluminum (Al) evident in the EDS maps of the cross section of

the dark red region confirm the use of an aluminum-silicate clay without the presence of calcite. The presence of mercury (Hg) in the top layer confirms cinnabar as a pigment. The cross section of the pink region reveals a stratigraphy more typical of Maya vessels: a layer of calcite mixed with aluminum-silicate clay, and a thin layer of an iron-based (Fe) pigment on top.

A more in-depth examination of the basal band of light blue-green pigment was completed for the other vessel in this set (cat. 13). Please refer to that entry for more information.

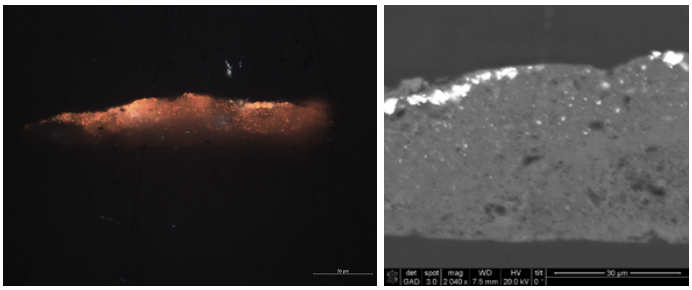


Fig. 2
(A) PLM micrograph of the first, dark red painting campaign of the central cartouche, showing cinnabar distributed throughout the upper layer. (B) SEM micrograph of the same region displays the bright areas correspond with mercury (cinnabar), which shines white under the microscope.

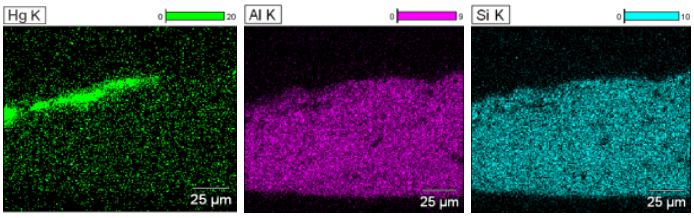


Fig. 3
EDS elemental mapping of the cross section of the red region shows mercury (Hg) as the main component of the pigment layer, and aluminum (Al) and silicon (Si) as the main components of the substrate.

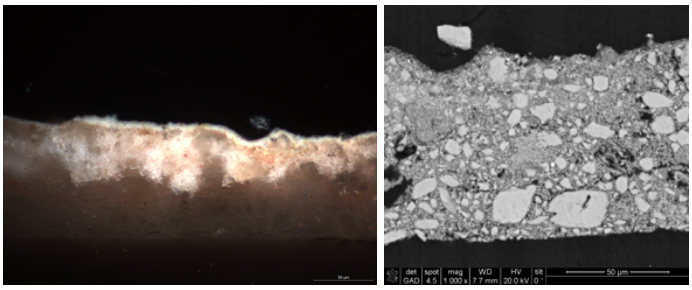


Fig. 4
(A) PLM micrograph of the second, lighter, pink painting campaign of the central cartouche verifies both cinnabar and ocher in the pigment layer. (B) SEM micrograph of the same region highlights the matrix of the substrate (or stucco layer), which was prepared with both lime and clay.

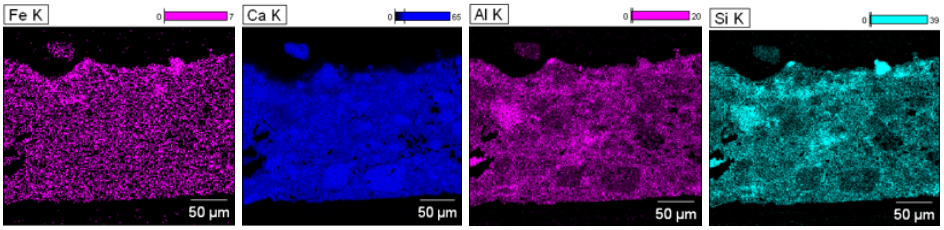


Fig. 5
EDS elemental mapping of the cross section of the pink region, which shows iron (Fe) as the main component of the pigment, and calcium (Ca), aluminum (Al), and silicon (Si) as the principal components of the matrix.

Cat. 13

Tripod Cylinder Vessel in Teotihuacan Style

Peten, Guatemala, late 4th–early 5th century CE
Slipped ceramic with stucco and postfire pigment
Height: 9 in. (22.9 cm); diameter: 9 in. (22.9 cm)
Anonymous gift
M.2010.115.1068a–b
K7530

Each of the six cartouches on this stuccoed vessel depicts a building reminiscent of the Teotihuacan architectural style. Each bears a twisted element on its roof that may represent the twisted cord used in fire drilling. This element appears on sculptures associated with the Sun Pyramid at Teotihuacan that may mark that massive pyramid as a place for New Fire ceremonies, known from the later Mexica civilization, in which fire was generated to celebrate particular calendrical anniversaries. The images on this vessel may refer to a Teotihuacan building or to a type of Maya fire shrine created in the wake of contact with Teotihuacan.[4] Like the previous vessel (cat. 12), this tripod cylinder is topped by a lid with an anthropomorphic head and has pillow-like supports with exposed firing vents.

4 William L. Fash, Tokovinine, and Barbara W. Fash, "The House of New Fire at Teotihuacan and Its Legacy in Mesoamerica," in *The Art of Urbanism: How Mesoamerican Kingdoms Represented Themselves in Architecture and Imagery*, eds. Fash and Leonardo López Luján (Washington, D.C.: Dumbarton Oaks Trustees for Harvard University, 2009), 201–29.

Cat. 13

Studies of Manufacturing Techniques

X-Radiography

As seen in the radiograph, the clay body of this vessel is remarkably similar to that of cat. 12, suggesting these two vessels may have been made in the same workshop or with similar clay-preparation techniques.

Rollout Photography

The painted surface of this vessel is more intact compared to that of the previous vase (cat. 12); however, in the few spots exhibiting surface loss, the exposed ceramic indicates that this vessel was also burnished to accommodate the stucco layer. Close observation of the object and these high-resolution images suggests the following painting sequence: First, the artist applied a layer of white stucco to the burnished ceramic, and then added a layer of a pink, iron-based pigment (probably ocher). The cartouches were then traced, filled in with distinct colors, and subsequently outlined and detailed in black. The basal band of light blue-green pigment was added directly on top of the white stucco layer.

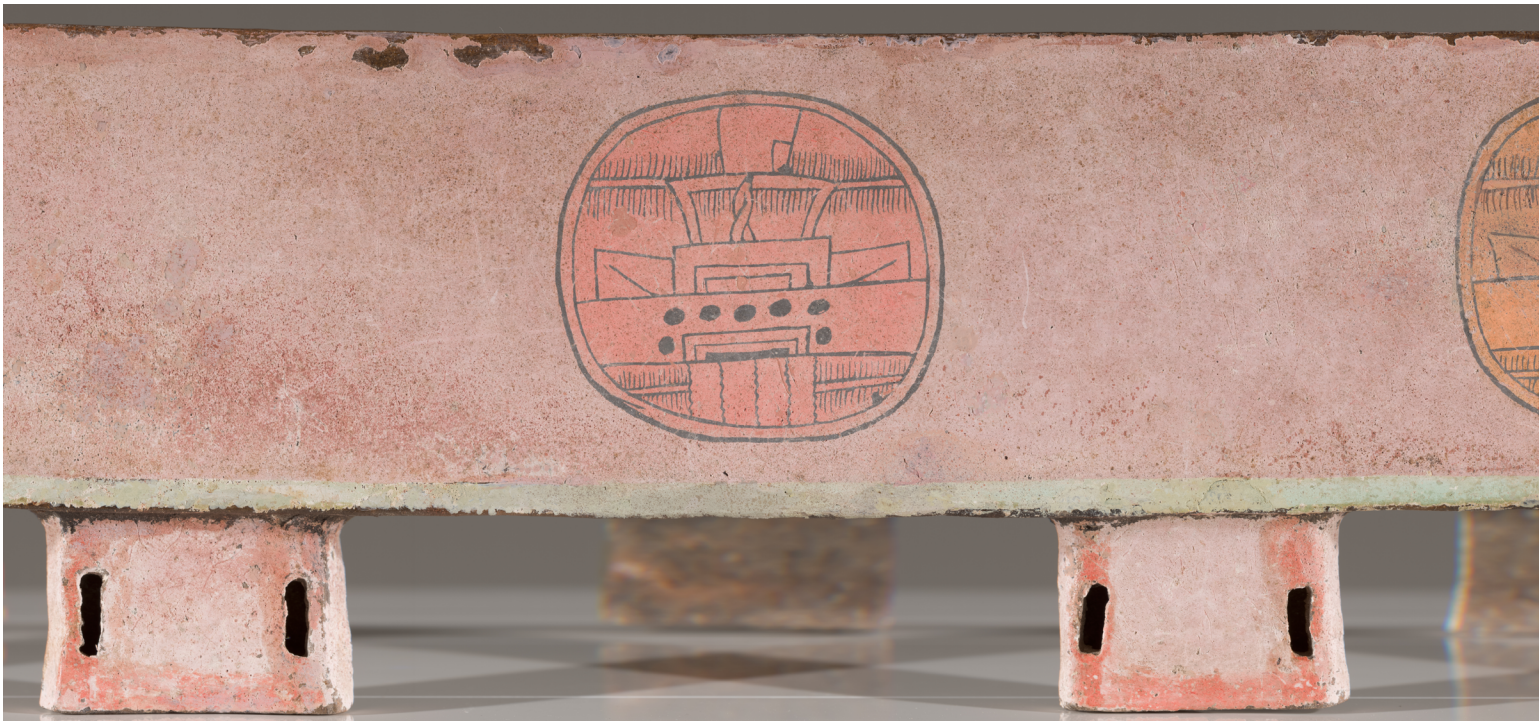
FCIR Imaging

In FCIR, the light blue-green color—found at the base of the vessel, on the rim of its lid, and in the cartouche on the right-hand side of the image—shifts to blue. This suggests the use of a copper-based pigment (like pseudo-malachite; see “Material Analysis,” below). It is interesting to note that, unlike most other black engobes in this study set, the black postfire-applied pigment does not acquire a reddish-brown hue in FCIR but instead refracts greenish black. This suggests that the pigment does not contain manganese and is probably carbon-based. Analysis using pXRF spectroscopy did not identify manganese on the stuccoed surface of the vessel, which supports this assessment.

UVF Photography

Photographs taken under ultraviolet light reveal evidence of modern conservation treatments on the vessel’s painted surface. Darker regions on one of the cartouches pertain to instances of modern repaint. On the pink background, black splotches indicate where conservation treatment has been performed.

Cat. 13



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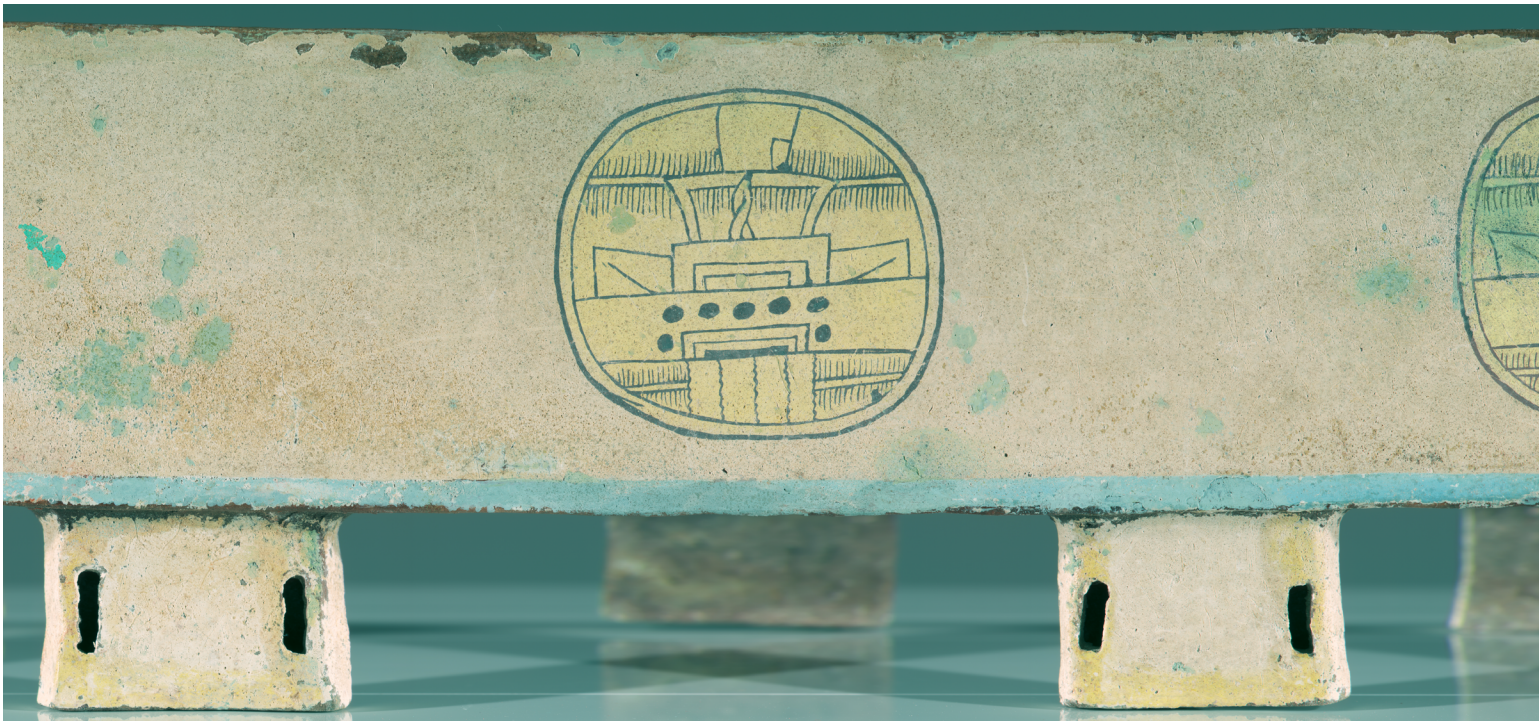
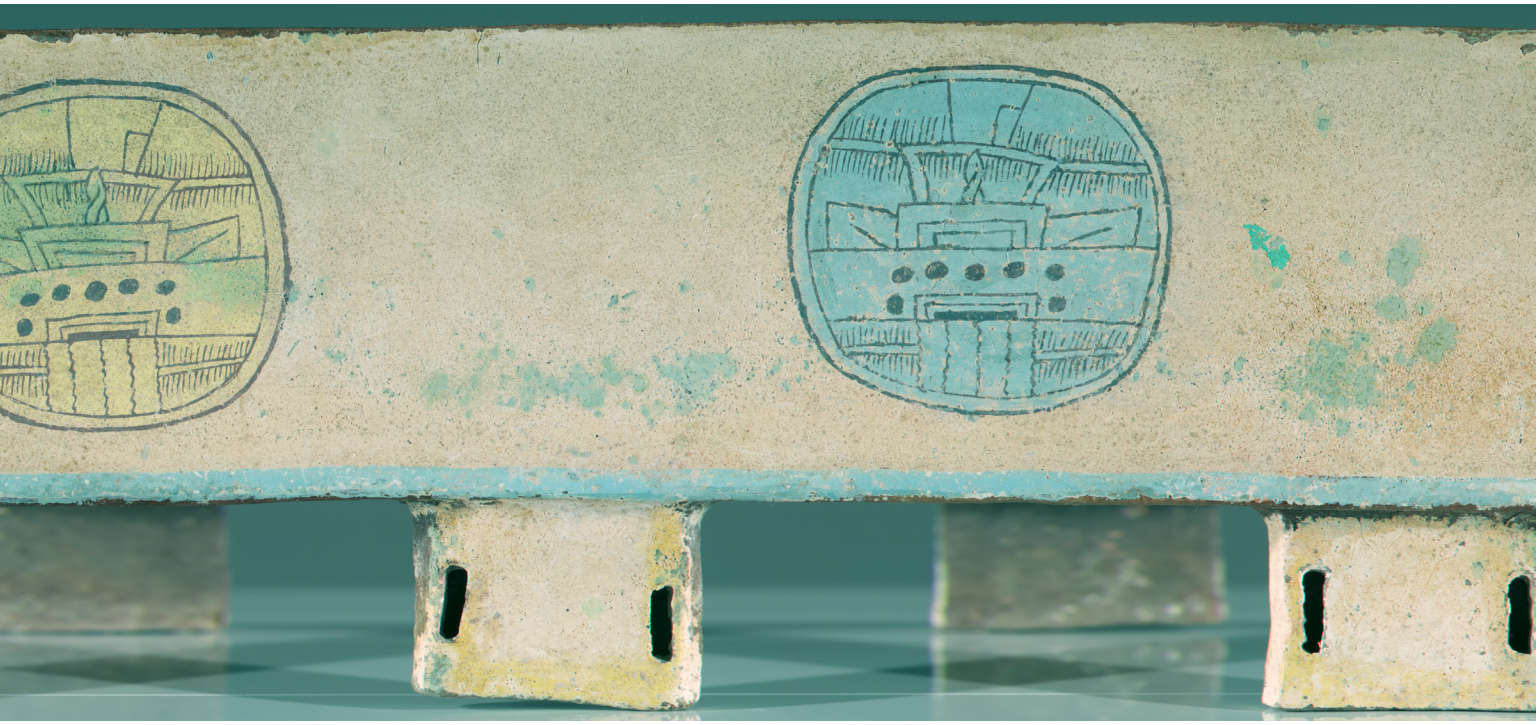




Material Analysis

Analysis using pXRF spectroscopy detected aluminum, silicon, calcium, and iron in all examined sites, implying the presence of calcite, an aluminum-silicate clay, and iron from the ceramic body and/or iron-based pigments (fig. 6). In the light red background, mercury was found along with iron, indicating the use of cinnabar as a pigment and iron-based compounds in the pigment layer and/or clay body. The red cartouche contains the same elements, with mercury being predominant, while in the orange cartouche, iron predominates. These small differences in proportion account for the difference in hues. The basal band and the green cartouche mainly contain copper along with some phosphorus, suggesting the presence of a copper-based pigment. EDS also confirmed the presence of copper and phosphorous in the pigmented layer. Further analysis, such as XRD and/or Raman spectroscopy, would be required to confirm that pseudomalachite, a phosphate of copper, was used in the green areas.

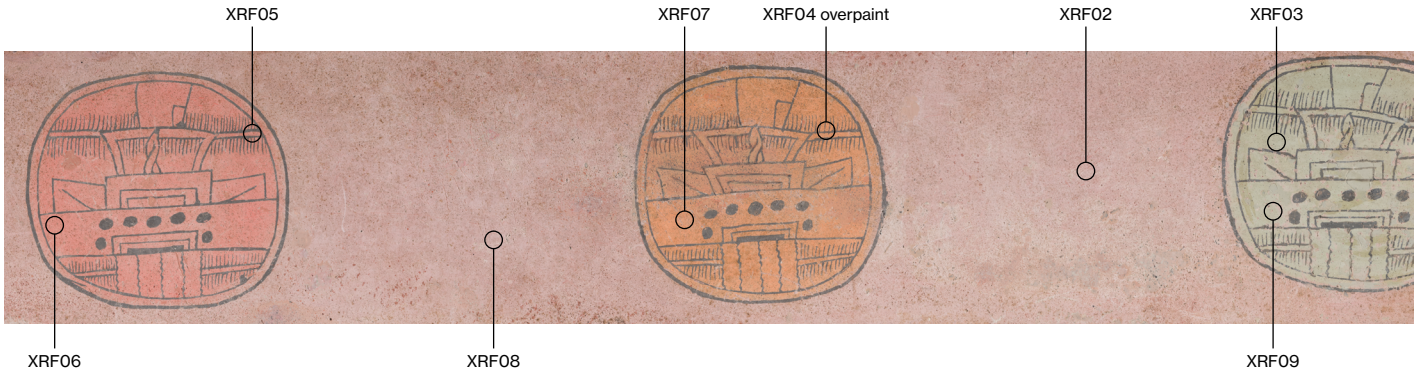


Fig. 6
Rollout photograph marking locations analyzed with pXRF spectroscopy

A PLM micrograph of samples taken from the green basal band shows a compact white base layer underneath a thinner layer of green pigment (fig. 7a). The SEM micrograph of the same cross section reveals that the white base encompasses two distinct layers. The first layer, in direct contact with the burnished surface of the vessel, contains relatively coarse particles that likely help it adhere to the vertical surface of the ceramic (fig. 7b). The long, thin particles evident in the second layer resemble those observed in the SEM micrograph of the previous vessel (cat. 12), suggesting that not only the clay body but also the painted stucco were manufactured in the same workshop. The particles also seem to exhibit a consistent orientation. This may indicate that the stucco was applied in one direction, from right to left, the artist likely rotating the vessel counterclockwise as it was painted. EDS elemental maps of the same cross section show the concentrations of calcium (Ca), aluminum (Al), silicon (Si), copper (Cu), and phosphorus (P) in the sample (fig. 8). The presence of these elements and their distribution suggest that calcite comprises the ground layer, while the thinner pigment layer contains a copper-based pigment mixed with an aluminum-silicate clay to help bind the pigment to the stucco layer. With respect to the composition of the pigment layer, the elemental mapping replicated the findings of the spectroscopy.

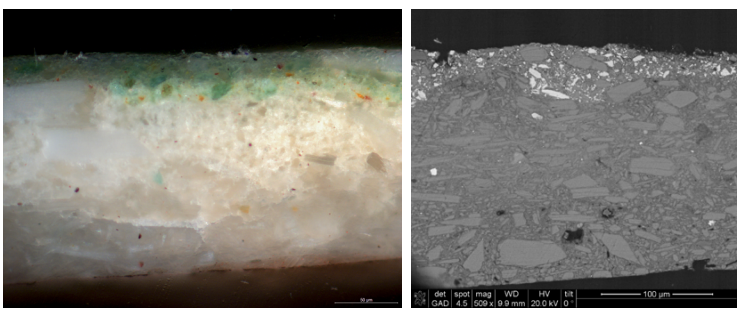


Fig. 7
(A) PLM micrograph presenting a cross section of the green basal band. (B) SEM image showing two distinct layers of stucco plus the green pigment layer on top. The pigment layer is composed of pseudomalachite (bright white particles), calcite, and an aluminum-silicate clay.

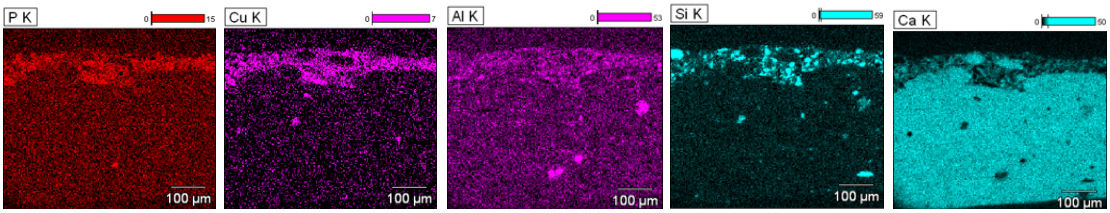


Fig. 8
EDS elemental mapping of the green basal band, which shows calcium (Ca) as the principal component of the stucco lime matrix, aluminum (Al) and silicon (Si) comprising the clay binder for the pigment layer, and phosphorus (P) and copper (Cu) as the main components of the pigment.

Cat. 14

Tripod Cylinder Vessel in Teotihuacan Style

Peten, Guatemala, late 4th–early 5th century CE
Slipped ceramic with stucco and postfire pigment
Height: 8 1/2 in. (21.6 cm); diameter: 8 in. (20.3 cm)
Anonymous gift
M.2010.115.1067a–b
K7528

The lid and side walls of this vessel bear a dedication inscription rendered across multiple cartouches painted in red and orange divided diagonally. The inscription names the vessel's owner as a *yajaw* (vassal) of Jatz'oom Kuy, also known in contemporary scholarship as Spearthrower Owl, who may have been from Teotihuacan.[5] This reference to Jatz'oom Kuy in the Maya hieroglyphic text strengthens the connections evident in the vessel's style. The stucco-painted tripod cylinder vessel was a typical ceramic form used by Teotihuacan artists that Maya artists emulated during the fourth and fifth centuries.

5 Simon Martin, *Ancient Maya Politics: A Political Anthropology of the Classic Period, 150-900 CE* (Cambridge: Cambridge University Press, 2020), 242; Stuart, "'The Arrival of Strangers': Teotihuacan and Tollan in Classic Maya History," in *Mesoamerica's Classic Heritage: From Teotihuacan to the Aztecs*, eds. Carrasco, Lindsay Jones, and Scott Sessions (Boulder, CO: University Press of Colorado, 2000), 465–513.

Cat. 14

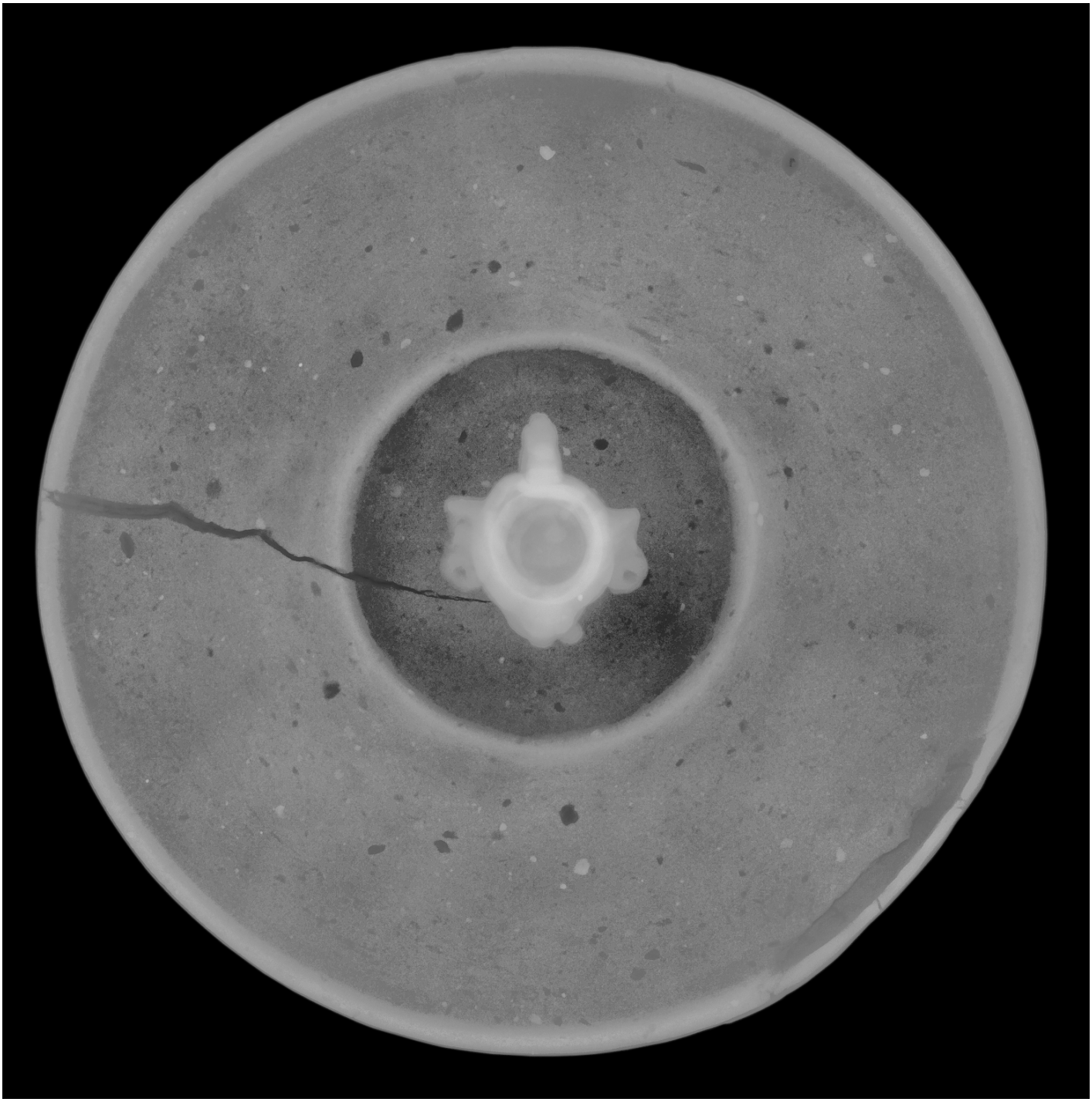
Studies of Manufacturing Techniques

X-Radiography

The form of this vessel is similar to the previous two works discussed in this group (cats. 12 and 13): The three vessels have thin concave walls; a shallow concave floor; three squared hollow legs; and, each has a slightly curved, conical lid topped by a sculpted head. Additionally, all are stucco-painted with a similar color palette. Nevertheless, radiographs reveal significant differences in the composition of this vessel's clay body, which is characterized by sizable, rounded voids left by burned-out inclusions, likely seeds. The use of organic siccatives suggests an attempt to mitigate the sticky nature of the clay. The absence of inorganic temper such as *sah kab* and sand distinguishes this vessel from the stylistically similar works discussed above. Despite these differences, neutron activation analysis of the three vessels reveals clay chemistry consistent with works created from the same clay source.[6] One could speculate that this vessel was made in the same workshop as cats. 12 and 13 but with a different batch of clay, collected and prepared at a different time.

6 See Reents-Budet and Bishop, "Pottery of the Central and Eastern Peten," in this volume.

Cat. 14



Rollout Photography

Upon visual examination of the object, the dark, burnished surface of the ceramic body can be observed in areas of paint-surface loss on the vessel and lid. Six cartouches adorn the body of the vessel, and four are visible on the lid (although it can be deduced that there were originally six cartouches on the lid as well). A layer of white stucco serves as a base for the colored paints. The orange of each cartouche was applied first, followed by the red. While applying color to the vessel, the artist was careful to respect the boundary between cartouche and background: In no instance does the green pigment overlap with either the orange or the red. The black pigment of the glyphs was applied last.

FCIR Imaging

FCIR imaging indicates that Maya blue pigment was not used for this vase; this finding is consistent with cats. 12 and 13. The light blue-green hue surrounding the cartouches shifts to a sky-blue color in FCIR, suggesting a colorant derived from copper (e.g., malachite) rather than indigo (i.e., Maya blue). The black lines remain black in FCIR, which indicates the use of carbon black rather than manganese-based pigments, another finding consistent with cats. 12 and 13.

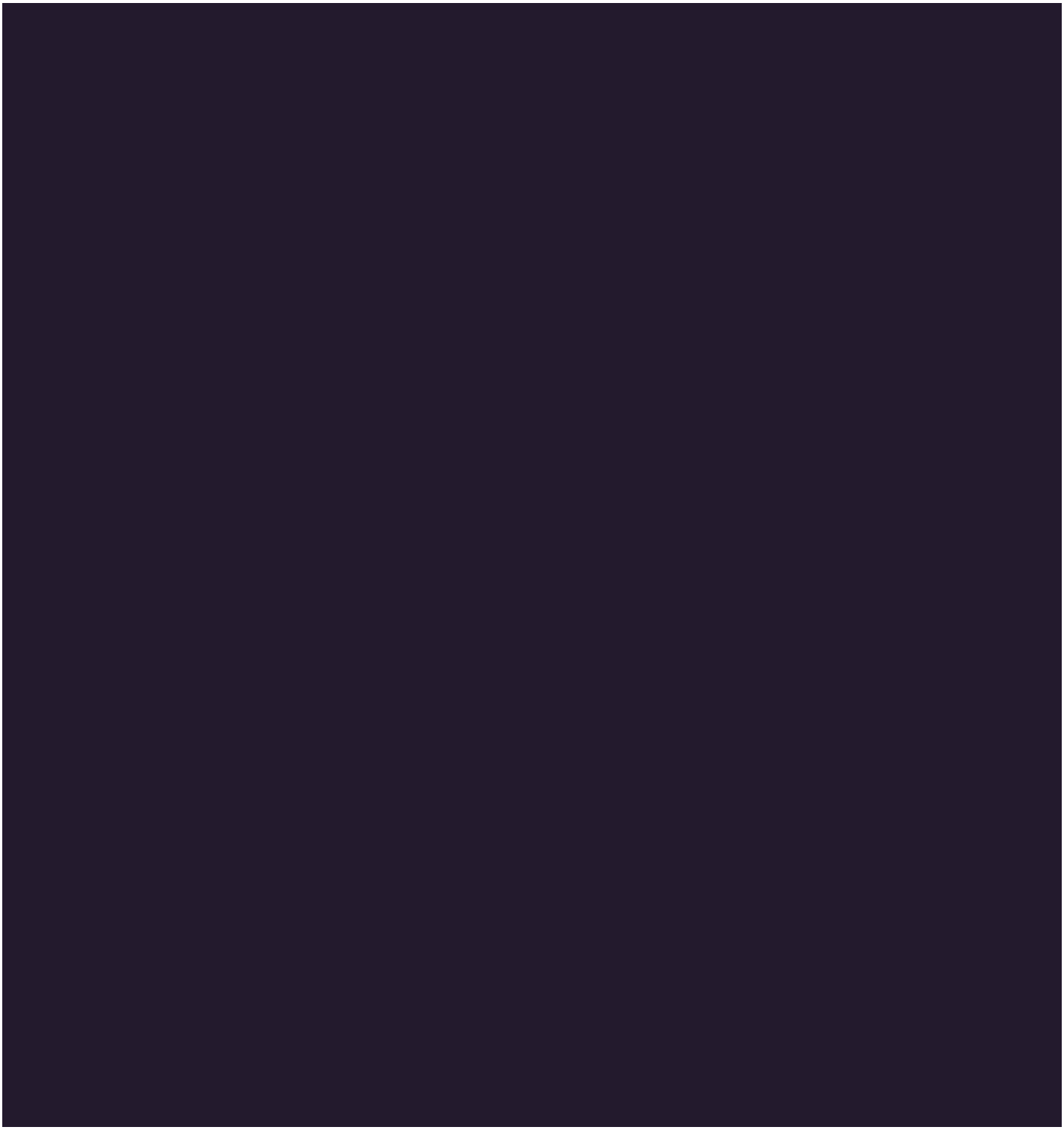
UVF Photography

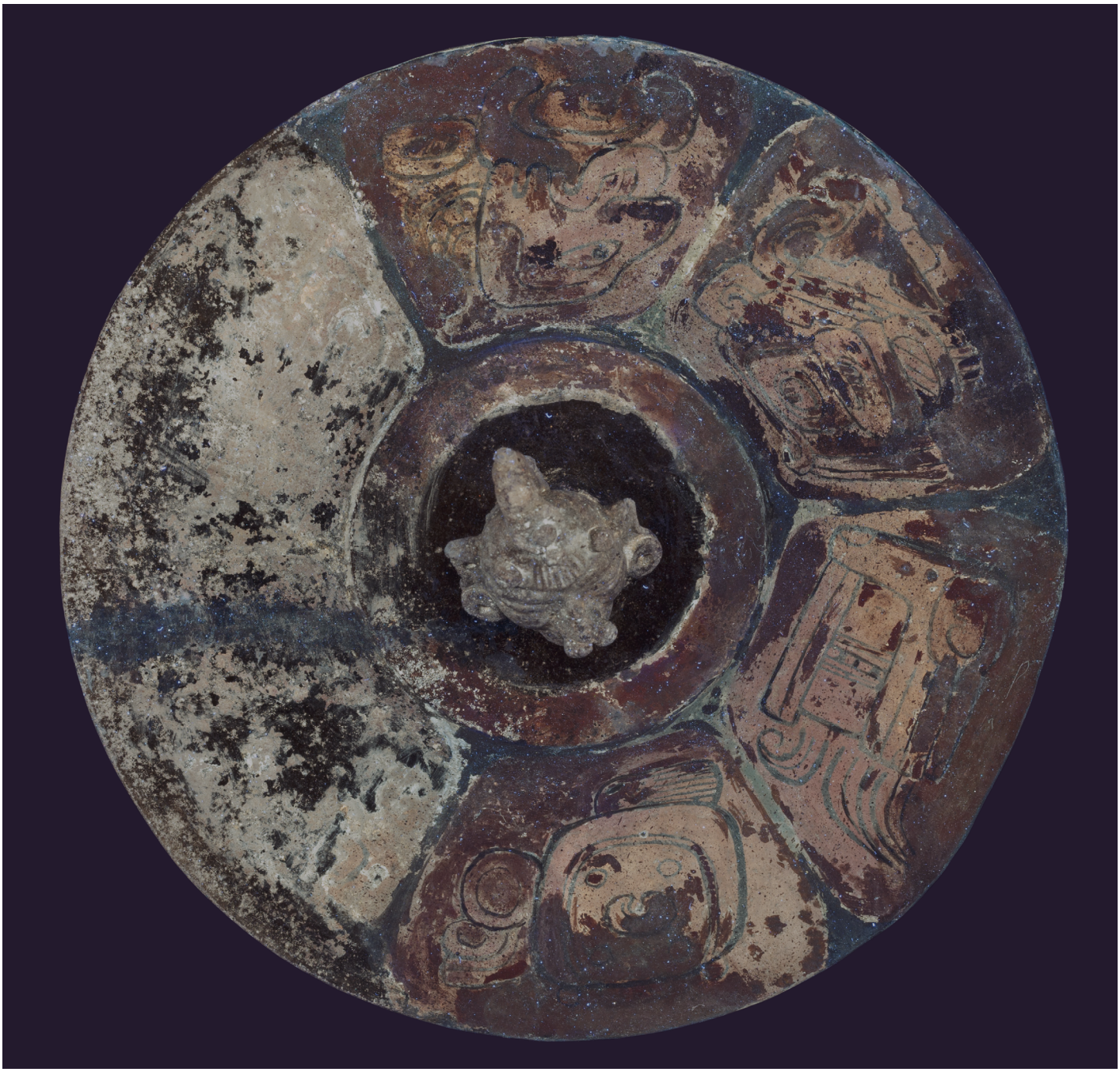
The dark regions that become apparent under ultraviolet light pertain to areas where modern conservation treatments have been performed on the painted surface of the vessel. These treatments are extensive, likely indicating an unstable and damaged paint layer.

Cat. 14

Cat. 14

Cat. 14





Material Analysis

Aluminum, silicon, calcium, and iron were found at all sites analyzed with pXRF spectroscopy, indicating the presence of calcite, an aluminum-silicate clay, and iron, which pertains to ocher pigments and potentially comprises part of the ceramic body as well (fig. 9). Both mercury and iron were detected in the red and orange areas of the cartouches, suggesting the use of cinnabar and iron-based pigments (e.g., ocher). The light green background surrounding the cartouches contains mainly copper and trace amounts of phosphorus, demonstrating the use of a copper-based pigment. As with cats. 12 and 13, further analysis (e.g., XRD) would be necessary to confirm the use of pseudomalachite.

Fig. 9
Rollout photograph marking locations analyzed with pXRF spectroscopy

A PLM micrograph of a cross section of the light green background shows two distinct layers, a compact white base layer supporting a thinner pigment layer composed of green and white particles (fig. 10a). In the pigment layer, the small size of the light green particles suggests that the artist ground the pigment until reaching the desired hue. An SEM micrograph of the same cross section reveals the texture of the substrate, in which the orientation of particles follows the direction that the artist applied the layer (fig. 10b; also see cat. 13). The green particles, which appear as bright spots in the SEM images, are small and sparse compared with the surrounding matrix. EDS elemental mapping of this cross section highlights the concentration and distribution of calcium, copper, aluminum, silicon, and phosphorus, which indicate the following: The artist prepared a ground composed primarily of calcite, and on top of that applied a pigment layer consisting of a copper-based pigment (possibly pseudomalachite, a copper-phosphate pigment) mixed with an aluminum-silicate clay (fig. 11). These data, together with the x-radiography, suggest that both the set of cats. 12 and 13 and this vessel were likely made in the same workshop but at different times or by different artists.

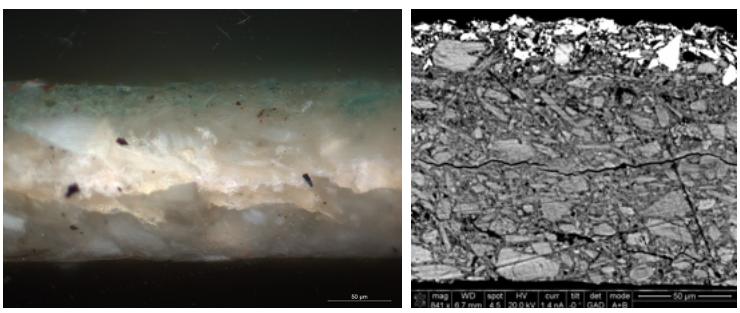


Fig. 10
(A) PLM micrograph of a cross section of the light green background. (B) SEM image showing the stucco substrate and the green pigment layer on top. The pigment layer is composed of pseudomalachite (bright white), calcite, and clay.

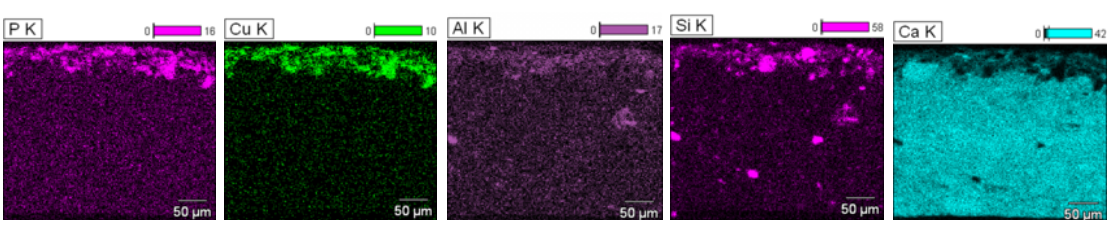


Fig. 11
EDS elemental mapping of the light green background exhibits the pseudomalachite particles (composed of phosphorus [P] and copper [Cu]) and the aluminum-silicate clay binder (composed primarily of aluminum [Al] and silicon [Si]) that comprise the pigment layer, as well as the stucco lime matrix, composed mainly of calcium (Ca).

Cat. 15

Lidded Tripod Cylinder Vessel with Head of Cacao Deity

Naranjo or vicinity, Peten, Guatemala, early 5th century CE
Slipped ceramic with stucco and postfire pigment
Height: 11 1/2 in. (29.2 cm); diameter: 5 1/4 in. (13.3 cm)
Purchased with funds provided by Camilla Chandler Frost
M.2010.115.22a–b
K8042

The dedicatory text painted postfire on this vessel is rendered across cartouches, creating a phrase that begins on the vessel body and moves to the lid. The cartouches are diagonally divided in blue and white, likely to create a shimmering effect. The phrase names the vessel as a *yuk'ib* (drinking vessel) for a particular chocolate drink, *kakaw*, that is qualified as *tzih* (fresh) or *suutz* (cherry-fruit).[7] The patron or owner is named Naatz Chan Ahk, who bears the *sak chuwen* title associated with the kingdom at Naranjo, Guatemala.[8] The hollow head on the lid is made from a mold, with ear and hair ornaments added. Its production was similar to that of Maya figurines: It was attached to a hole cut into the lid and fired together. This one has been identified as the Maya chocolate god, and the vessel containing chocolate would form the god's body.[9]

7
Stuart et al., "Glyphs on Pots: Decoding Classic Maya Ceramics"; Dmitri Beliaev, Albert Davletshin, and Tokovinine, "Sweet Cacao and Sour Atole: Mixed Drinks on Classic Maya Ceramic Vases," in *Pre-Columbian Foodways: Interdisciplinary Approaches to Food, Culture, and Markets in Ancient Mesoamerica*, eds. John E. Staller and Carrasco (New York: Springer, 2010), 257–72.

8
Simon Martin and Nikolai K. Grube, *Chronicle of the Maya Kings and Queens: Deciphering the Dynasties of the Ancient Maya*, 2nd ed. (London: Thames & Hudson, 2008), 70–71.

9
Stephen D. Houston, Karl Taube, and Stuart, *The Memory of Bones: Body, Being, and Experience among the Classic Maya* (Austin: University of Texas Press, 2006), 36–38.

Cat. 15

Studies of Manufacturing Techniques

X-Radiography

Radiographs indicate that the clay body was formulated using marl (*sah kab*) as the principal temper, and it appears well distributed throughout the ceramic as minute, rounded gray particles. The potter also incorporated a small amount of organic material as a siccative, likely chopped dried grass or reeds, which are visible as elongated black voids. The radiopaque (i.e., dense) areas appear white on the radiograph and indicate relatively thick walls. Darker spots evidence the process of pinching the clay coils in the shaping of the vessel wall, which led to areas of thinness. Additionally, from the horizontal pattern of thinner (darker) and thicker (lighter) bands in the clay body, it is possible to deduce that the method of building this vessel was coiling. The vessel exhibits consummate skill in preparing the clay body and manufacturing the object.[10]

[10] For a comparably refined vessel, see cat. 18.

Rollout Photography

The way the artist prepared this vessel's painted surface differs from that of the other postfire stucco-painted vessels in this project's study set. In this case, dolomitic lime stucco was mixed with clay and pigments and then applied as a colored paste, specifically in the cartouches. The shape and the modeling of the feet, together with the postfire decoration over a stucco ground, are reminiscent of the tradition of stucco-painted vessels from Teotihuacan.[11] The body and lid bear four cartouches each, and the lid has a knob in the shape of a human head. The burnished surface of the vase is visible where the paint layer is missing. Before applying the layer of stucco, which served as a ground for the postfire paint, the clay body was finished with a layer of dark brown slip that was burnished and fired.[12]

FCIR Imaging

The blue-green pigment used to paint this vessel shifts to a sky blue in FCIR, ruling out the use of an indigo-based pigment (i.e., Maya blue), which would take on a vivid magenta hue. Instances of modern repaint and restoration are visible in two color refractions: The red used to repaint damaged areas in the background color refracts blue-green, while the restoration inside the blue-green cartouches refracts light pink.

UVF Photography

Under ultraviolet light, modern interventions and repaint appear dark and opaque compared with the original pigments.

11
Diana Magaloni Kerpel, Megan E. O'Neil, and María Teresa Uriarte, "The Moving Image: Painted Murals and Vessels at Teotihuacan and the Maya Area," in *Teotihuacan: The World Beyond the City*, eds. Kenneth G. Hirth, David M. Carballo, and Barbara Arroyo (Washington, D.C.: Dumbarton Oaks Research Library and Collection, 2020), 189–220.

12
The authors have not determined whether the ceramic paint underneath the layer of stucco meets the criteria of an engobe, as defined by Hirx, "Reconstructing Ancient Maya Ceramic Practices," in this volume; and thus is labeled as "slip" here.

Cat. 15

Raking-light Images

Raking-light images reveal texture by placing a light source almost parallel to the surface of the object. In one image (fig. 12, right), the thick application of red-pigmented stucco can be seen abutting and overlapping the edge of a cartouche. In other areas (fig. 12, left), the painting of the black lines appears to have indented or lightly incised the surface of the stucco.

Fig. 12

Material Analysis

Analysis with pXRF spectroscopy indicates that the red background is composed mainly of iron, calcium, aluminum, and silicon (fig. 13). This suggests a mixture of an iron-based pigment, such as ocher, with an aluminum-silicate clay on a calcite ground. The blue-green pigment was identified as copper based. The border on the lid also contains copper mixed with slaked lime and clay. The black contour lines of the cartouches seem to be organic, likely carbon black.

Fig. 13
Rollout photograph marking locations analyzed with pXRF spectroscopy

Samples were taken at the interface between one of the cartouches and the red background (fig. 14a). Two cross sections were mounted in resin and observed with a polarized light microscope (PLM). The micrographs of the red side of the interface show three distinct layers: the base layer, compact with fine particles distributed throughout; the second, a thin red layer incorporating some coarse white particles; and the uppermost layer, with a slightly translucent quality, revealing a mixture of small light green particles and elongated, coarse white particles (fig. 14b). The micrographs from inside the cartouche exhibit two layers, a base containing a mixture of light green particles and coarse white ones, and a thinner, translucent layer similar to the uppermost layer noted for the other sample (fig. 14c). A comparison of the two samples, noting the location of their collection, suggests that the artist left the space for the cartouches untouched while painting the red background.

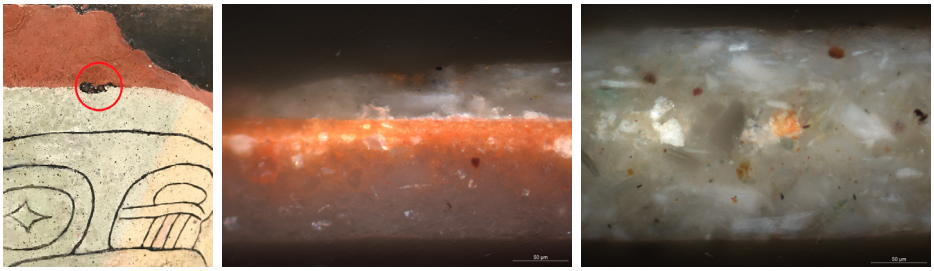


Fig. 14
(A) Detail showing the location of the sample. (B) PLM micrograph of a cross section of the red side of the sample.
(C) PLM micrograph of the light green side of the sample (inside the cartouche), where two distinct layers can be discerned.

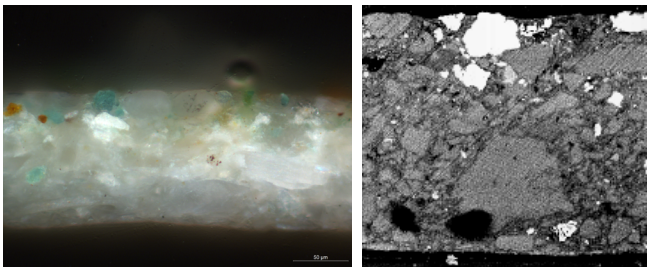


Fig. 15
(A) PLM micrograph of the light blue-green pigment, in which crystals of malachite are evident. (B) SEM micrograph highlighting the crystals of malachite (in white) enmeshed in a matrix of calcite and clay.

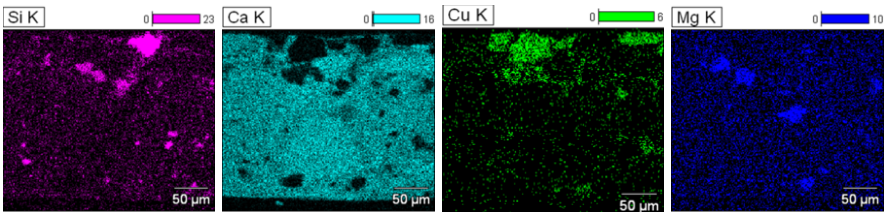


Fig. 16
EDS elemental mapping of the cross section of the light blue-green pigment, showing silicon-based (Si) aggregates in the pigment layer, a well-distributed calcite (Ca) matrix present in both the substrate and the pigment layer, a copper-based (Cu) pigment (i.e., malachite), and a fairly even distribution of magnesium (Mg) that indicates the lime matrix is dolomitic.

A second cross section of the light green pigment further clarifies the structure of the postfire-painted stucco. A PLM micrograph makes evident the blue-green crystals of malachite, while the SEM image situates these crystals (which appear white) in a coarse matrix of calcite and clay (fig. 15). EDS elemental mapping of this cross section confirms the presence of a copper-based pigment, such as malachite, in the pigment layer (fig. 16). Silicon also appears to be an important aggregate in this layer. This, along with the distribution of calcium throughout the sample, suggests that the colored pigment was mixed with calcite and a silicate clay to create a composite light green paint that, due to its clay component, had substantial adhesive qualities.

Based on scientific analysis and visual examination of the vessel, the following painting sequence can be deduced. The artist first applied a layer of white stucco made with a dolomitic (i.e., containing magnesium) lime. (Note that this component is not present in the other stuccoed vessels considered in this group, particularly cats. 12–14.) Then, the background red color was painted on top of the stucco, with spaces for the cartouches left reserved. These spaces were divided, diagonally, into two halves: On the upper half, the special blue-green mixture of lime, clay, and malachite was painted; on the lower half, a white mixture composed of just lime and clay was applied.

Cat. 16

Tripod Vessel with Supernatural Musicians

Guatemala or Mexico, 500–700 CE
Slipped ceramic with stucco and postfire pigment, including Maya blue
Height: 6⁵/₈ in. (16.8 cm); diameter: 6 in. (15.2 cm)
Purchased with funds provided by Camilla Chandler Frost
M.2010.115.21
K1534

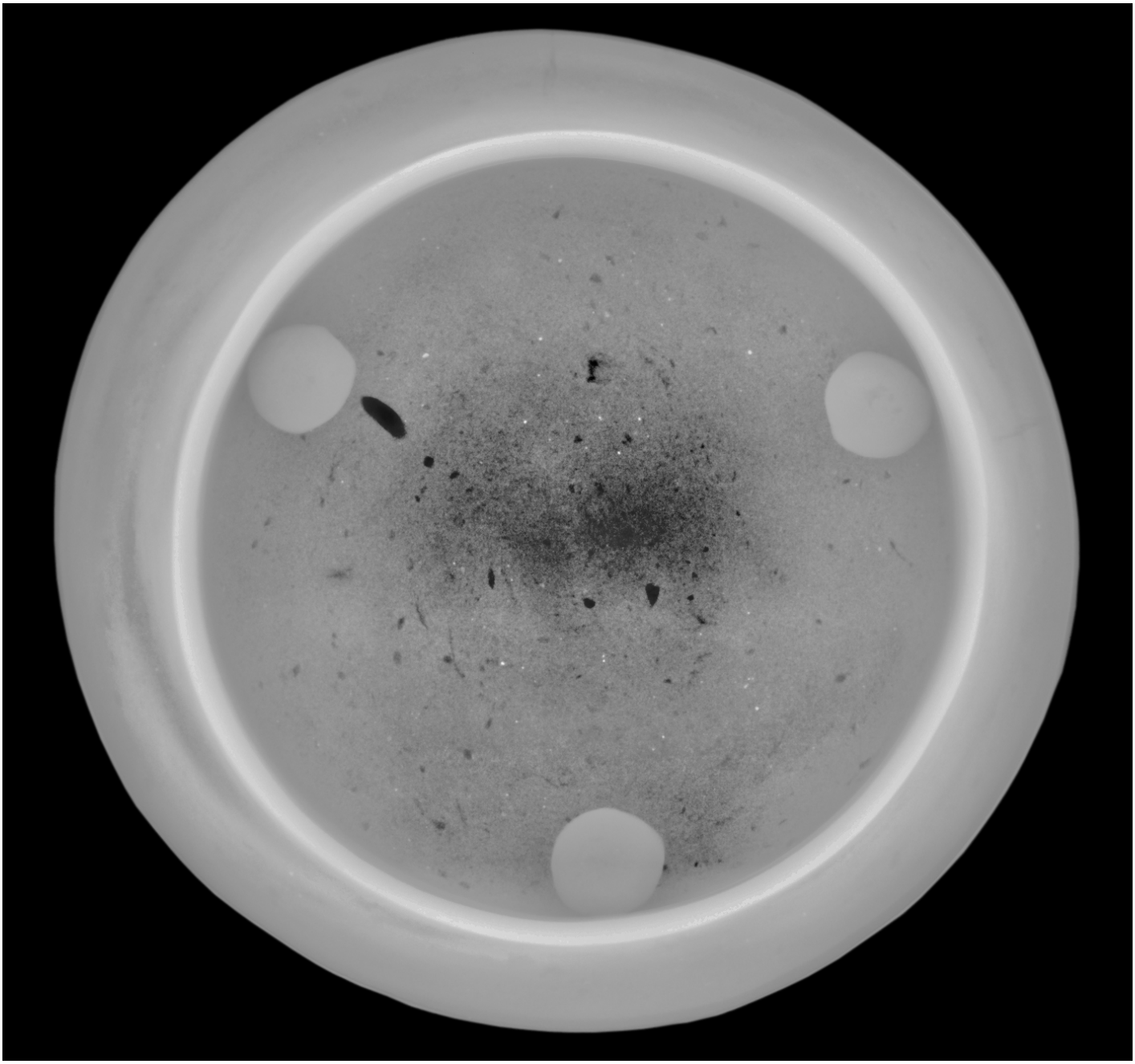
This small footed cup bears a magnificent scene, painted post-fire, of a rattle-bearing musician rising from the centipede maw of the underworld. It is a scene of rebirth after death. Accompanying the musician is a vulture playing a drum covered with a jaguar pelt. The technique and aesthetic of this painted vessel share connections with Late Classic Maya mural painting at places such as Bonampak, Mexico, as well as with earlier painted stuccoed vessels from the Maya area and Teotihuacan.

Like earlier Maya vessels, the exterior surface was slipped and burnished before firing. After firing, the vessel was painted first with Maya blue, in what is essentially a tinted plaster layer. The artist applied a white layer (calcite) in specific areas to map the design of the ancestor, vulture, and centipede before using cinnabar and ocher in different combinations of red and orange to create the volumetric forms of the bodies. Lastly, the artist added outlines and details in a gray pigment consisting of calcium mixed with carbon black (identified with Raman spectroscopy) and a brown pigment (not yet identified). This layering of pigments is analogous to the layering of colors in Late Classic Maya mural painting.

X-Radiography

Radiographs indicate the incorporation of organic siccatives, which appear as dark, rounded voids in the clay body. The use of organic siccatives implies a naturally sticky clay. Inorganic temper, which helps in the firing process by conferring thermal shock resistance, appears in the radiograph as white flecks and could pertain to levigated sand. There is also evidence of the use of *nooy*, which can be seen as evenly distributed gray specks. Both the siccatives and the two forms of inorganic temper follow a horizontal pattern that suggests coiling. Coiling is also evident in the radiograph of the vessel floor, in which the counterclockwise spiral of the coil can be discerned.

Cat. 16



Rollout Photography

As with the other vessels in this group, the painting technique used on this vessel differs from that of vessels painted with engobes. Here, the paints do not transform through fire but are applied postfire over a lime-stucco ground. In this manner, the vase becomes technically and materially akin to a mural painting. The stucco base was prepared in a manner similar to that of the grounds of murals; however, for ceramics like these, the first ground layer was a mixture of lime and clay. The layers of pigments attach to the ground likely through the adhesive abilities of lime and the aid of an organic binder (which we have not identified). The Maya developed a sophisticated technique of painting with polysaccharides, such as orchid gum and the gum extracted from certain tree barks,[13] and further analysis might confirm that this vessel was painted in a similar fashion. This technique of stucco painting allows for an expanded palette of colors, but the painted surfaces are more vulnerable because they do not bond directly with the ceramic body.

FCIR Imaging

In the FCIR images for this vase, the pink hue corresponds with indigo, the main colorant of Maya blue. The refraction of indigo contrasts with copper-based blue-green pigments, which refract as sky blue (as seen on cats. 12–15). The brown areas take on a dark green hue, suggesting the use of a carbon-based colorant. In FCIR, all red pigments turn yellow, as is the case for this vase; thus, this technique is not diagnostic of the constituent materials. However, pXRF spectroscopy and EDS elemental mapping confirm that cinnabar and ocher comprise the red and orange hues (see discussion below).

13 Magaloni, "Materiales y técnicas de la pintura mural Maya," in *La pintura mural prehispanica en México II: Área Maya*, book 3, *Estudios*, ed. Leticia Staines Cicero (Mexico City: Instituto de Investigaciones Estéticas, Universidad Nacional Autónoma de México, 2001), 155–98.

Cat. 16

Material Analysis

Analysis using pXRF spectroscopy helps to determine the pigments used by the artist (fig. 17). Both mercury and iron were detected in the red areas, suggesting the presence of cinnabar and iron-based pigments (e.g., ochers). Calcium and silicon were detected in all locations analyzed, indicating that the substrate consists of lime stucco mixed with clay. The background was painted with Maya blue, an artificial pigment created by dyeing palygorskite clay with indigo. No inorganic pigment, such as malachite, was detected through pXRF, which contrasts with the Early Classic stuccoed vessels (cats. 12–15). Through Raman spectroscopy, the brown color in the face of the supernatural drummer was identified as carbon black (fig. 18). Analysis with pXRF spectroscopy also assisted in the identification of elements in the ceramic body: Aluminum, silicon, and iron were detected, suggesting the use of an aluminum-silicate clay with ferrous inclusions.

PLM micrographs of cross sections of the red-pigmented areas show four layers, from bottom to top: The first's light blue hue is visible in the digital microscope image of the same fragment (fig. 19). On top of this thick base layer, a pink mixture of red pigment and calcium carbonate serves as a colored substrate for the painted layers. The third layer, while thin, can be distinguished in this micrograph by its

Fig. 17
Rollout photograph marking locations analyzed with pXRF spectroscopy

vibrant orange hue and fine, round particles, identified as cinnabar. A ferrous pigment with a darker brownish-red hue makes up the fourth and uppermost layer.

Comparing the PLM and the SEM micrographs helps clarify how the artist formulated the stucco so it adhered perfectly to the ceramic wall while also serving as an adequate surface to receive pigments (fig. 20). From bottom to top, the stratigraphy is as follows: The first layer of stucco was formulated by mixing lime, clay, and hard aggregates with an effective distribution of sizes. Calcium and aluminum, the main components of marl or *sah kab*, act as the principal fillers for the stucco. (*Sah kab* is also used as a filler in the lime plasters of Classic Maya murals.) The second layer of stucco, which has a light pink hue in the PLM image, is composed of lime and aggregates without evidence of silicates or clays (see EDS mapping). The artist employed different aggregates for this second substrate, mainly calcium carbonate (crushed calcite). This would have created a less-absorbent substrate or primer, preventing the bleeding of pigments. Thus, the first layer of stucco was formulated to adhere to the ceramic walls, while the second was intended to receive pigmented layers in a similar manner to mural painting. The first layer of pigment is cinnabar, which has a vibrant orange color in the micrograph and reflects as bright white particles in the SEM image. On top of the cinnabar, the artist applied a tinted glaze consisting of a translucent white clay (likely palygorskite or montmorillonite) mixed with red pigment in order to manipulate the underlying red tones.

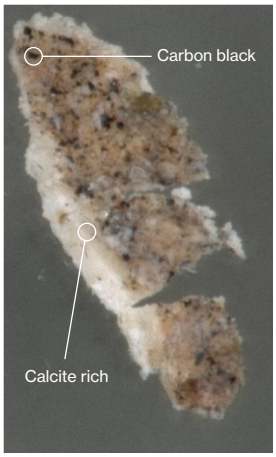
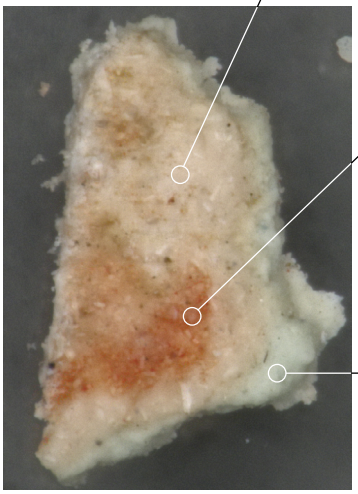


Fig. 18
Digital microscopy of the brown pigment



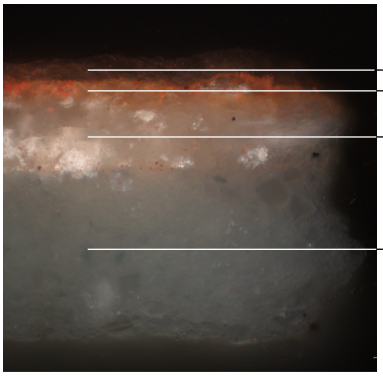


Fig. 19
(A) Stereomicroscopic image of a sample of red pigment, in which the lime stucco substrate and three pigment layers are visible. (B) PLM micrograph of a cross section of the same sample, with its stratigraphy labeled.

EDS elemental mapping confirms these findings and further elucidates the materials and how they were used (fig. 21). The extensive distribution of calcium (Ca) confirms lime as the principal component of the two stucco layers and as a significant additive to the uppermost pigment layer. Silicon (Si), the main component of clays, is present in the base layer of the substrate but is absent from the second. It is also the main component of the tinted glaze (the uppermost layer). Mercury (Hg) is the main element in cinnabar and makes up the first pigment layer.

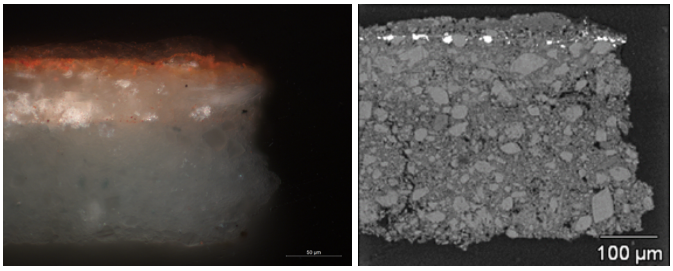


Fig. 20
Side-by-side comparison of a PLM micrograph and an SEM image of the same cross section: (A) PLM micrograph exhibiting two layers of lime and clay substrate and two layers of red pigment and (B) SEM image clarifying the lime matrix and marl aggregates

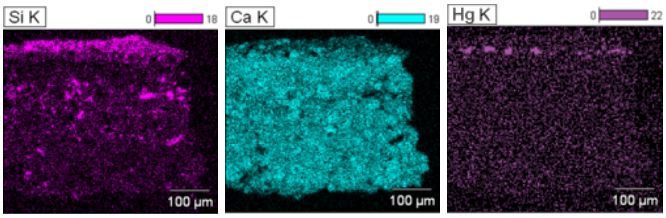


Fig. 21
EDS elemental mapping showing the distribution of silicon (Si), calcium (Ca), and mercury (Hg) throughout the cross section of the red pigment

Group 4

Exemplary Forms

Cat. 17

Tripod Vessel with Supernatural Palace Scene and Cacao Tree

Motul de San José or vicinity, Peten, Guatemala, 750–850 CE
Engobe-painted ceramic
Height: 12 in. (30.5 cm); diameter: 6¹/₄ in. (16 cm)
Purchased with funds provided by Camilla Chandler Frost
M.2010.115.430
K631

This vessel is sculpted into a building with a protruding ring near the top to evoke a thatched roof or cornice. The roof is painted with thatch designs, and beneath are a painted pillar, bench, and steps, creating a Maya palace. Unfolding within this space is a supernatural scene related to the emergence of the primordial cacao tree. Seated on the bench, an aged deity, God L, gestures toward K'awiil, the lightning god.[1] K'awiil motions toward a cacao tree, laden with cacao pods, that grows from a male body. The arrangement may relate to the idea that K'awiil as lightning breaks open the earth for the emergence of crops such as maize and cacao. These personages are framed by attendants wearing large quetzal-feathered backracks. Beneath them, a woman grinds what may be cacao on a metate, and a man motions toward a plate of tamales. In contrast to the neater, more careful lines of other vessels, the black outlines here appear expressive and spontaneous, giving an energy to this vessel and its supernatural scene.

1 Simon Martin, "Cacao in Ancient Maya Religion. First Fruit from the Maize Tree and Other Tales from the Underworld," in *Chocolate in Mesoamerica: A Cultural History of Cacao*, ed. Cameron L. McNeil (Gainesville, FL: University Press of Florida, 2006), 154–83.

Cat. 17

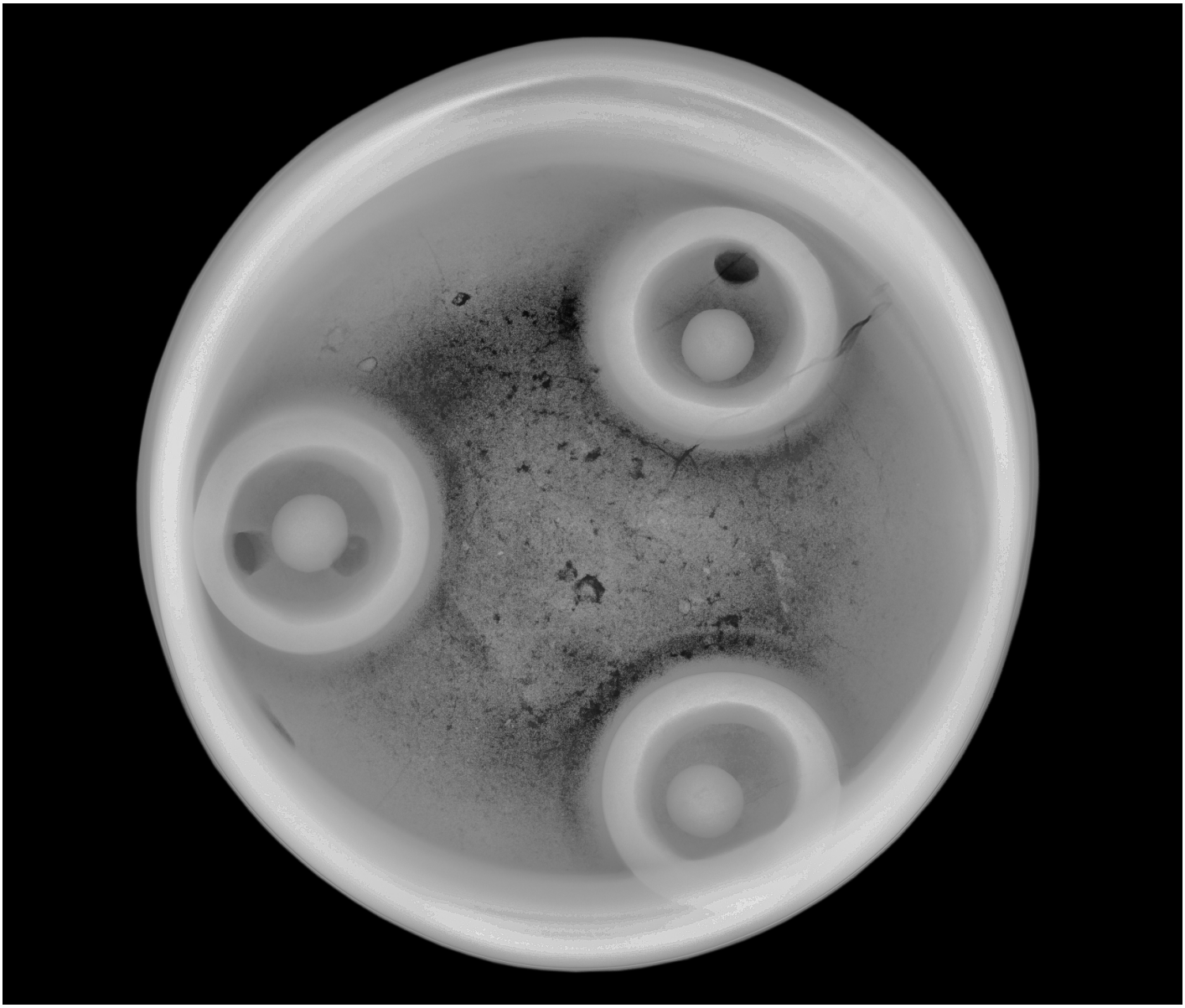
Studies of Manufacturing Techniques

X-Radiography

The building process of this vase can be discerned through x-radiography. The vertical crack that propagates from rim to floor indicates construction composed of discrete stacked rings as opposed to a single spiral coil; the crack formed where the ends of each ring meet (i.e., the weakest point in the structure of the vessel wall). Additionally, the rings are visible as parallel, horizontal bands of alternating light and dark. Two lighter bands close to the rim pertain to thick, protruding rings that the potter intentionally left unflattened to give dimension to the painted thatched roof (see Megan O'Neil, this volume). Minute particles of *nooy*, a special temper still used today by Yucatec Maya potters (see cat. 8), appear well distributed throughout the texture of the clay body as gray flecks. The extensive use of this inorganic temper makes this vessel comparable to cat. 18.

The vessel's tripod supports also function as rattles—each containing a ceramic ball that makes sounds when the vessel is moved. Notably, the radiograph provides evidence for how the feet were attached to the body. The three dark, concentric lines surrounding each foot, also visible when examining the vessel, pertain to impressions left by the potter as continuous pressure was applied to the clay, the potter turning the vessel to ensure consistency. Ethnographic evidence suggests that Maya potters have conceived various methods to rotate their vessels both continuously and discontinuously (see John Hirx and Megan O'Neil, this volume). Such an even, uninterrupted impression indicates a smooth, continuous rotation, something that would have required a special device to assist the potter (e.g., a cloth mat; see cat. 18).

Cat. 17



Rollout Photography

This vessel exhibits a relatively low-contrast color scheme. The subtle difference in hues between the background's orange and the reds of the figures and the architectural elements evokes the dim light of the underworld, where the scene is set.[2] Analysis using pXRF shows that these red and orange engobes are iron based. To create the pink color used for the loincloths and the jewelry, the artist modified the deep red engobe with a whitening agent, which pXRF identified as containing calcium. This may pertain to a number of minerals, including calcium carbonate (lime), calcium sulfate (gypsum), and calcium silicate (wollastonite). All three decompose in the firing process, leaving only calcium behind. This calcium-rich whitening agent is readily visible under ultraviolet light, where it refracts as bright white.

FCIR Imaging

The rollout in FCIR helps clarify the choices the artist made in coloring the scene's precious materials, such as cacao pods and feathers (fig. 1). In visible light, these features have a greenish-gray hue. Under FCIR, two distinct layers of engobe are evident. The first corresponds with a diluted manganese-based engobe that refracts a weak reddish hue. On top of this, a second layer of engobe was applied, in this case likely a mixture of carbon black and a white clay, which maintains a greenish-gray hue under FCIR. Further analysis would be necessary to confirm the presence of carbon black.

Fig. 1
Side-by-side comparison of the same detail in (a) visible light and (b) FCIR. Note how the color shift of the cacao pods and feathers reveals two distinct layers of colored engobe; the reddish layer underneath is likely composed of a manganese-based engobe, while the greenish layer on top is likely carbon black (to be confirmed with further analysis).

2
Diana Magaloni, "El espacio pictórico teotihuacano: Tradición y técnica," in *La pintura mural prehispánica en México I: Teotihuacán,* book 2, *Estudios*, ed. Beatríz de la Fuente (Mexico City: Instituto de Investigaciones Estéticas, Universidad Nacional Autónoma de México, 1996), 187–225; Magaloni and Tatiana Falcón, "Pintando otro mundo: Técnicas de la pintura mural en las tumbas zapotecas," in *La pintura mural prehispánica en México III: Oaxaca*, book 3, *Estudios*, ed. de la Fuente (Mexico City: Instituto de Investigaciones Estéticas, Universidad Nacional Autónoma de México, 2008), 177–226; Byron Hamann, "The Social Life of Pre-Sunrise Things: Indigenous Mesoamerican Archaeology," *Current Anthropology* 43, no. 3 (June 2002): 351–82.

Cat. 17

Cat. 18

Cylinder Vessel with Pedestal Base ("The Perfect Pot")

Peten, Guatemala, or Campeche, Mexico, possibly Los Alacranes, 650–850 CE
Engobe-painted ceramic with postfire stucco and Maya blue
Height: 6 5/8 in. (16.8 cm); diameter: 5 in. (12.7 cm)
Purchased with funds provided by Camilla Chandler Frost
M.2010.115.13
K7524

Painted on this vessel are two diagonally oriented profile faces of serpentine supernatural entities with water lilies emerging from them, suggesting they are floating in water. These are images of the Water-Lily Serpent, a being that inhabits the surface of the primordial waters.

Near the upper rim, a carefully painted dedication text encircles the vessel, dedicating it for maize-tree-fresh cacao, a chocolate drink mixed with corn gruel. The owner's name includes the title Buuk ajaw, lord of Buuk, an ancient kingdom or region in southern Campeche, Mexico, possibly centered at a place called Los Alacranes.[3] The vessel may have been commissioned or owned by a lord from this kingdom.

3 Martin and Grube, *Chronicle of the Maya Kings and Queens: Deciphering the Dynasties of the Ancient Maya*, 2nd ed. (London: Thames & Hudson, 2008), 104; Grube, "Toponyms, Emblem Glyphs, and the Political Geography of Southern Campeche," *Anthropological Notebooks* 11 (2005): 89–102.

Cat. 18

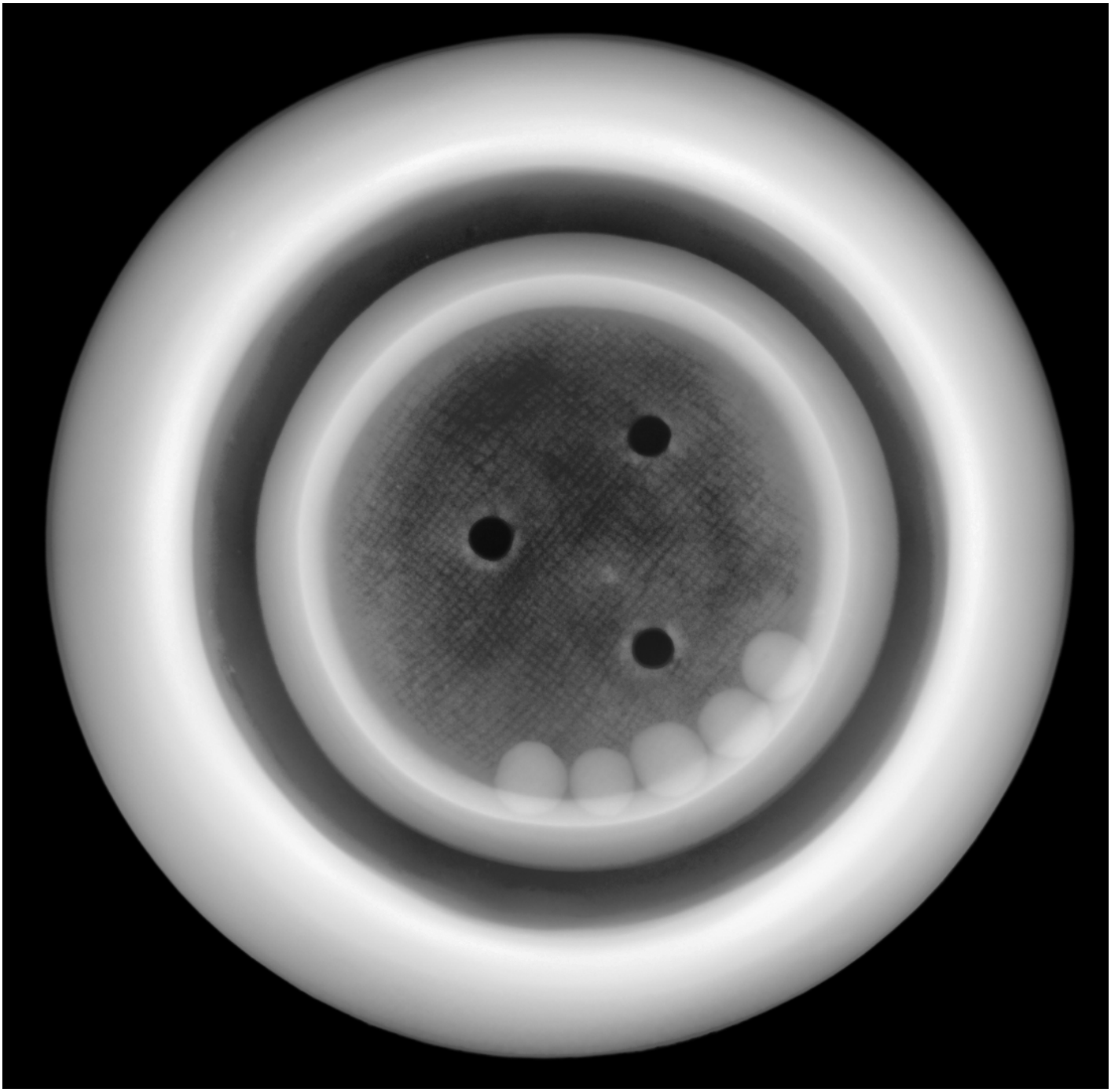
Studies of Manufacturing Techniques

X-Radiography

In this radiograph, the clay body has a homogenous appearance. Radiopaque particles (seen as rounded white spots) are few in number and unevenly distributed, suggesting they are not purposeful additives. However, there does appear to be a consistent distribution of tiny black voids, which may evidence the use of small organic siccatives like seeds that would have burned out when the vessel was fired. Minute dark gray specks, present throughout the clay body, may additionally point out the use of *nooy*—a mixture of palygorskite clay, also called *sak lu'um*, and powdered marl, or fine *sah kab*—as temper. However, *nooy* is difficult to detect in x-radiography because its radiodensity is similar to that of ceramic. The well-formulated clay body is indicative of a refined workshop practice (see also Hirx and O'Neil, this volume), which, among other traits that are discussed further below, inspired the nickname "The Perfect Pot" for this vessel.

Within the pedestal base are five clay rattles that produce sound when the vessel is turned or lifted. Even these rattles are almost perfectly spherical. A radiograph of the underside of the base shows an impression made by a loosely woven fabric, which provides insight into the manufacturing process of the vessel: It started with a disk that was flattened onto the textile; on top of this disk, the potter formed the walls with a spiral coil, using the textile to rotate the vessel. The three holes evident in the base serve two purposes—they allowed water to escape the chamber during firing, and they permit the rattle to emit sound.

Cat. 18



Rollout Photography

The painting surface was prepared with a primer of white engobe, likely derived from montmorillonite (smectite) clays. Then, the artist rendered the beautiful Water-Lily Serpent motifs with a translucent and glassy ceramic paint containing iron-based pigments. These motifs are crisp and deliberate, qualities likely achieved with a "stylus," a pointed instrument that would have helped to clean the edges of the figures (fig. 2). This technique appears particular to ceramics, and is not seen in Classic Maya (250–900 CE) mural or codex painting. The same red-orange engobe of the Water-Lily Serpent motifs was used to paint the glyphic text, which was then finished with dark red contour lines that create a subtle contrast between calligraphy and image (fig. 3). Finally, a second layer of white engobe was applied in order to color the background. After firing the vessel, the artist painted a band of Maya blue along its base and the interior of the rim (for more information on the composition of this basal band of Maya blue, see "UVF Photography," below).

As can be observed in the detail image, the second layer of white engobe is finer and brighter in tone, but it has attached poorly to the ceramic body in certain areas. When the pot emerged from the kiln, its surface would have been perfect. Over time, during the course of its interment, the outermost layer of white engobe destabilized. The shiny, translucent red-orange engobe, however, bonded durably to the ceramic surface. This suggests that the red-orange engobe was formulated with enough flux to allow the ceramic bonds to form properly. The white engobe, by contrast, seems to be lacking in flux. Analysis with pXRF spectroscopy identified chlorine in this white engobe, which suggests that a salt used in the paint caused it to spall (see Diana Magaloni et al., this volume). Modern restoration is discernible in the white brush strokes around the edges of the motifs (see fig. 2).

Fig. 2
Detail showing the destabilized white engobe and the sharp, clean edges of the red figure

Fig. 3
Detail of glyph with dark red contour lines

Cat. 18

Cat. 18

FCIR Imaging

When observed in FCIR, it is possible to trace the brush-strokes that rendered the red motifs, following the waning concentrations of paint. The red engobes reflect here as various shades of yellow, the darker the more concentrated, suggesting the presence of iron-based pigments. The pink hue on the pedestal base corresponds with the reflectance of indigo, the colorant of Maya blue (see cat. 16 for a comparable example).

UVF Photography

Under ultraviolet light, the regions where the second layer of white engobe has destabilized fluoresce in purple. The band of Maya blue on the pedestal base has a luminous white fluorescence, a quality that Maya blue alone does not have under ultraviolet light. Multispectral imaging indicates the presence of large quantities of calcium in this region, suggesting the application of postfire stucco underneath the layer of Maya blue to create a lighter hue.

Cat. 19
Globular Bowl with Cartouches

Naranjo or vicinity, Peten, Guatemala, 550–620 CE
Engobe-painted ceramic
Height: 7¹/₄ in. (18.3 cm); diameter: 7¹/₂ in. (19.1 cm)
Purchased with funds provided by Camilla Chandler Frost
M.2010.115.756
K6813

This globular bowl is shaped like a gourd or *tecomate*, a form used as a drinking bowl. It is painted with five cartouches holding supernatural zoomorphic entities, including a skull-headed figure of a monkey seated on a rounded form. Its dedication text names it as a drinking vessel for *kakaw*, here named as *sa'* or *sa'al kakaw*, which means it was either chocolate mixed with *ul* (maize gruel, also called *atole*) or it was chocolate from Naranjo, Guatemala.[4] The named owner is the Naranjo ruler Aj Numsaaj Chan K'inich (previously known as Aj Wosal Chan K'inich).[5] This individual was named on other chocolate vessels from Naranjo, including one in this book's study set (see cat. 8).[6] Here, the ruler is named as a 3 *k'atun ajaw*, meaning he was over forty years old when the vessel was produced.[7]

Dating to the Tepeu I period (c. 550–700 CE), this vessel is especially light and comparable to others of its type associated with Naranjo. Dorie Reents-Budet notes that this can be attributed to their construction with low carbonate temper.[8] The bottom of the vessel is flattened for stability.

4
Stephen D. Houston, "Into the Minds of the Ancients: Advances in Maya Glyph Studies," *Journal of World Prehistory* 14, no. 2 (June 2000): 121–201; Alexandre Tokovinine and Vilma Fialko, "Stela 45 of Naranjo and the Early Classic Lords of Sa'aal," *The PARI Journal* 7, no. 4 (Spring 2007): 1–14; David Stuart, "The Language of Chocolate: References to Cacao on Classic Maya Drinking Vessels," in *Chocolate in Mesoamerica: A Cultural History of Cacao*, ed. McNeil (Gainesville, FL: University Press of Florida, 2006), 184–201; Kerry Hull, "An Epigraphic Analysis of Classic-Period Maya Foodstuffs," in *Pre-Columbian Foodways: Interdisciplinary Approaches to Food, Culture, and Markets in Ancient Mesoamerica*, eds. John E. Staller and Michael Carrasco (New York: Springer, 2010), 235–55.

5
Martin and Dmitri Beliaev, "K'ahk' Ti' Ch'ich': A New Snake King from the Early Classic Period," *The PARI Journal* 17 , no. 3 (Winter 2017): 1–7.

6
Houston, "A Splendid Predicament: Young Men in Classic Maya Society," *Cambridge Archaeological Journal* 19, no. 2 (June 2009): 149–78.

7
Martin and Grube, *Chronicle of the Maya Kings and Queens*, 71.

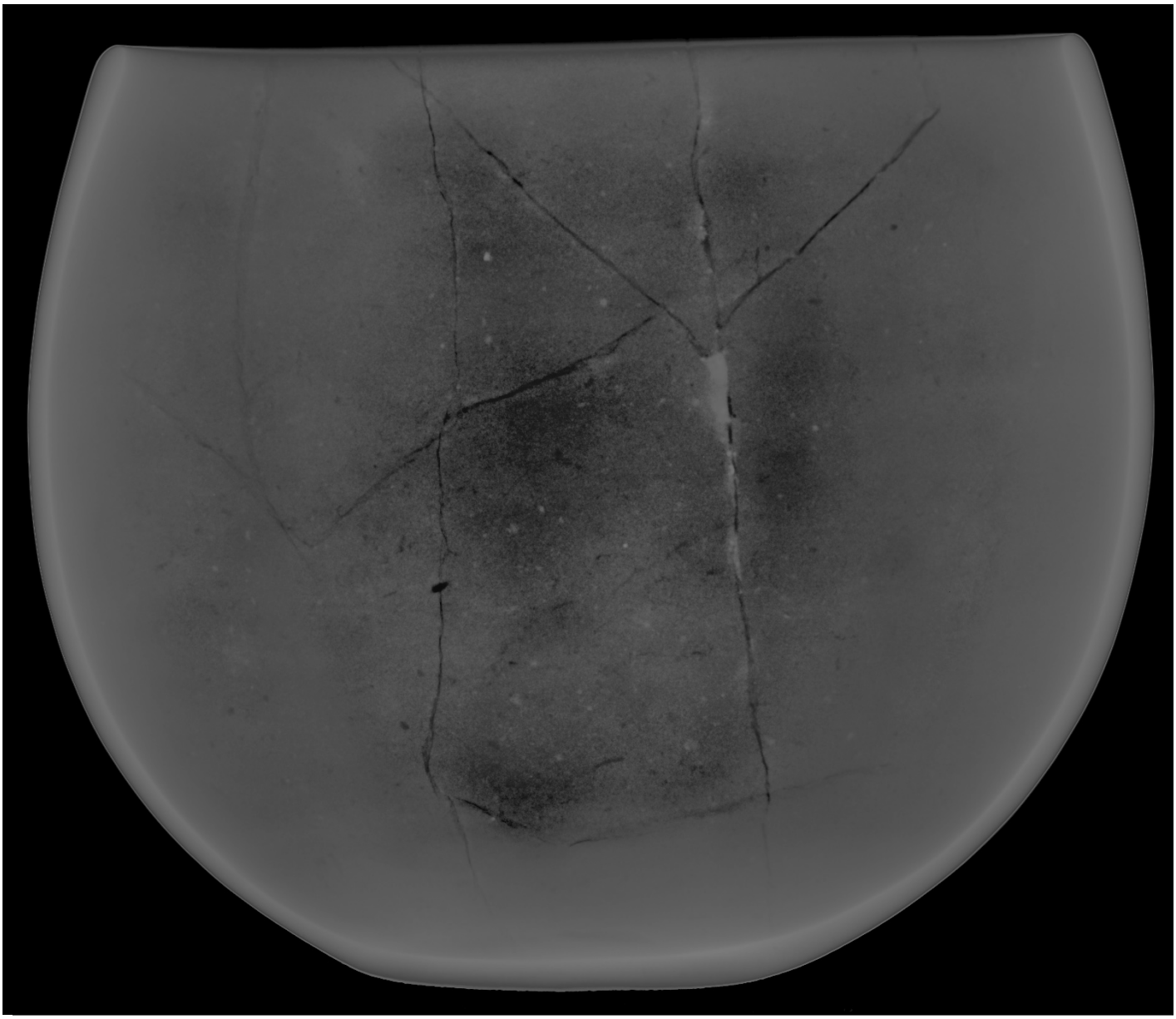
8
Dorie Reents-Budet, personal communication, 2016.

Cat. 19

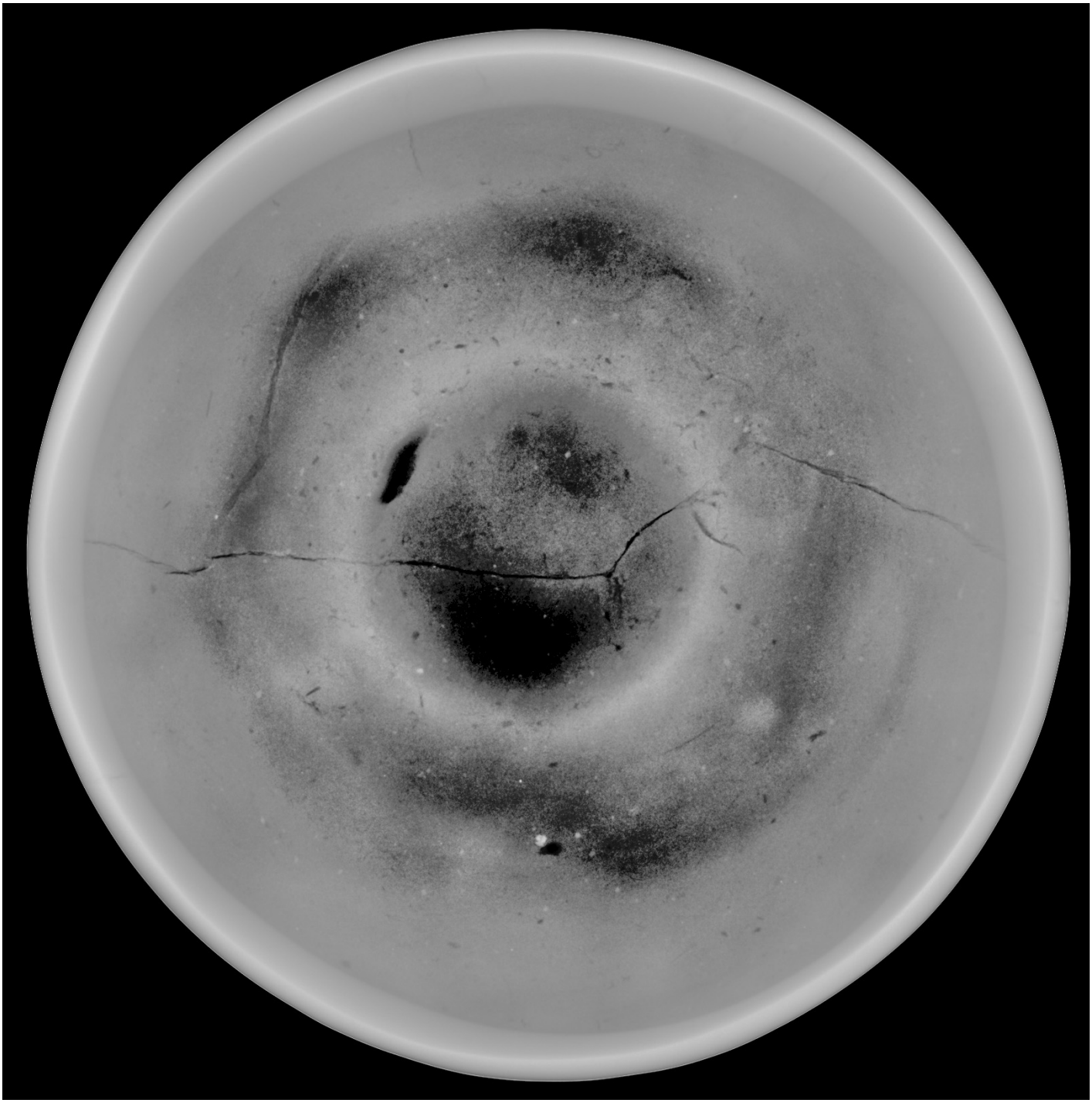
Studies of Manufacturing Techniques

X-Radiography

The potter masterfully formed this vessel in the shape of a rounded gourd, with remarkably thin and even walls. The crack pattern evident in the radiograph is consistent with breakage from internal pressure created in the burial environment; a restorer later repaired this damage. The clay body contains fine gray particles, which pertain to *sah kab* (marl), as well as a fair amount of dark voids, which pertain to burned-out organic siccatives like seeds (rounded voids) and chopped grass (elongated voids). The dark clouds in the radiograph correspond with areas that were thinned as the potter pressed the clay coils together; the marks left by the potter's fingers are arranged in horizontal bands, following the structure of the coiling. A top-down view of the vessel makes particularly apparent the thinness of the base, which is characterized by dark amorphous splotches in the radiograph. The lighter halo surrounding this area pertains to a ring of thickened clay that provides stability for the vessel where it sits.



Cat. 19



Rollout Photography

This drinking bowl exhibits a distinctive painterly quality compared with most of the other vessels in this project's study set. The engobes, particularly those that comprise the black background color, were applied in such a way that the loose strokes of the painting process remain visible. As is characteristic of Classic Maya ceramic painting, the first layer to be applied was a white engobe that served as primer and is still visible on the rim of the vessel (fig. 4). The artist then painted a layer of light orange engobe, which provides the background color for the cartouches as well as the glyph band. The anthropomorphic figures and glyphic text were then rendered with black and red engobes. The black engobe that covers most of the bowl's exterior surface was the last to be applied. Some surface loss in the black region appears to be due to root activity in the burial environment that may have further weakened the vessel's walls and led to their fracture.

Fig. 4
Top-down view of the vessel displays the white primer engobe still visible on the rim. Note the bowl's perfectly circular gourd-like shape.

FCIR Imaging

The black engobe that covers the exterior of the vessel reflects a burgundy color in FCIR. This particular reflectance may stem from the distinct layering of engobes present in this area: first, a white primer, followed by a thin orange layer, and finally topped with black. Analysis with pXRF was not performed for this vessel, so it is not possible to determine the elemental composition of the black engobe; however, its reddish hue in FCIR suggests a manganese-based pigment, albeit in a thinner formulation than that of cats. 10 and 22. Along the base of the bowl, the dark green hue likely pertains to repaint from a modern intervention.

Cat. 19

Cat. 19

Cat. 20

Lidded Vessel with Images of an Open Hand

Guatemala or Mexico, 580–700 CE
Engobe-painted ceramic
Height: 8 7/8 in. (22.4 cm.); diameter: 6 3/4 in. (17.3 cm)
Purchased with funds provided by Camilla Chandler Frost
M.2010.115.981a–b
K6964

On this barrel-shaped vessel, bands of abstract designs and a dedication text frame two hands with visible palms. Although the same hand repeats, together they appear to be grasping the vessel, which conveys the tactility of handling this heavy, textured object. On the lid are Teotihuacan-style butterflies. The dedication text uses a verb in the form of a footprint going up a temple stairway that may read *t'abay* (raise up). Interestingly, the action required to raise up or lift this vessel would require the placing of the palms on the sides, just as they appear graphically.

The artist or artists used a range of decorative techniques in the vessel's crafting, including shaping, painting (both positive application and resist painting), and incising. Its body and lid were created with coils, verified by both visual inspection and radiographs. Usually, potters smoothed coils, obscuring all evidence of the technique, but on this vessel's floor, the coils are not smoothed, and cracks have formed along them. This lack of smoothing provides further insight into the construction, allowing observers to see that the potter used slim or narrow coils. Radiographs show the evenness of the vessel walls, which were carefully crafted to form the barrel shape. The lid was made through coiling as well, and the x-ray images reveal the buildup of clay where the ring handle was pressed onto the lid, an inverted bowl-shape form.

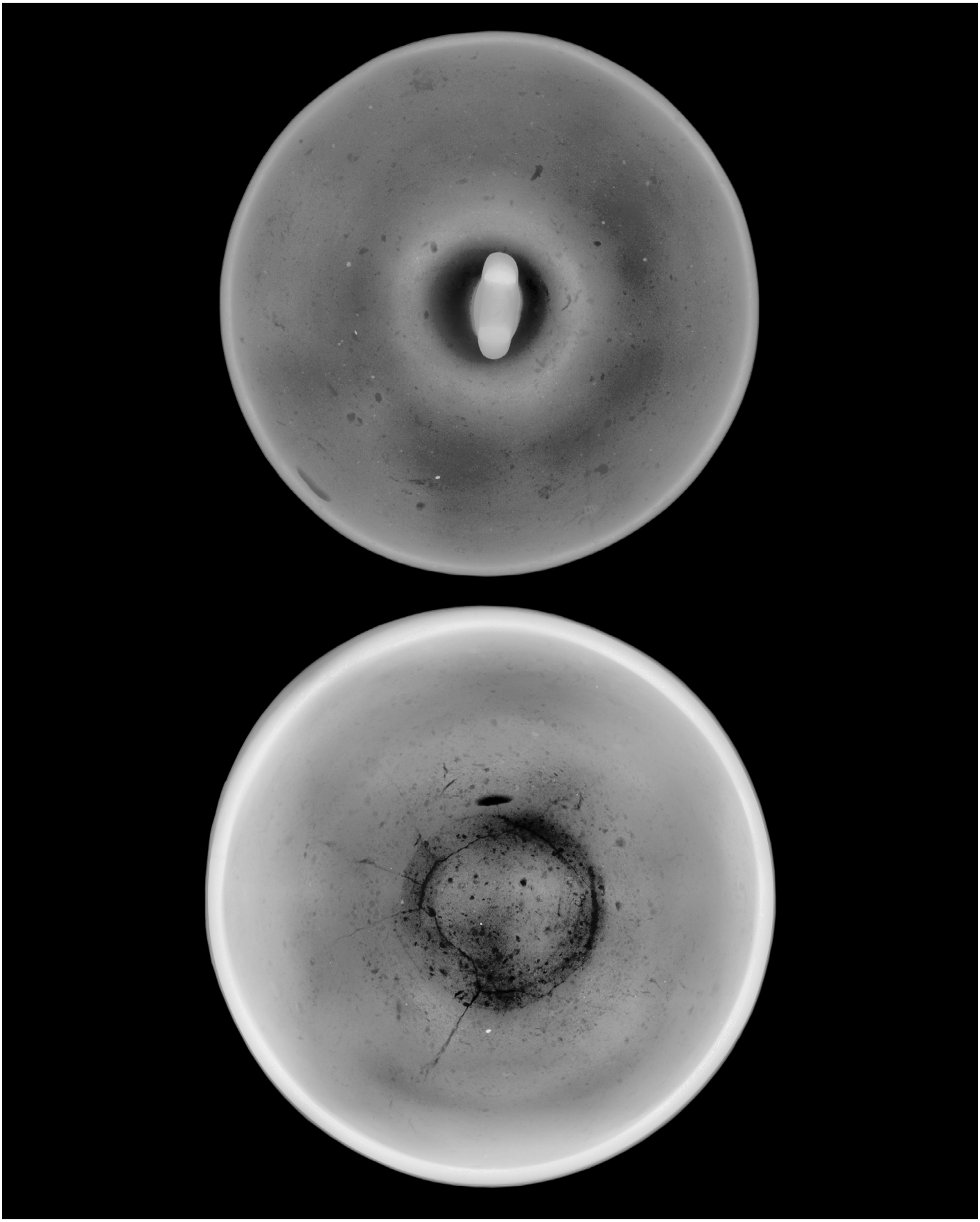
Cat. 20

Studies of Manufacturing Techniques

X-Radiography

A top-down radiograph of the interior of the vessel exposes the characteristic circular pattern of coiling, evident in shades of lighter and darker gray. The dark ring at the center of the base corresponds with a thin area in the coiling, which has since fractured. Radiographs of the accompanying lid similarly indicate a coiled construction. The dark region at the center of the image points out that the lid is thinnest where the ring-shaped handle is attached. An explanation for this can be proffered when the lid is viewed from the side: The potter appears to have affixed the handle to the lid by applying pressure from the inside, as finger marks left a circular impression in the clay. A frontal view of the main vessel reveals numerous light gray spots that may pertain to *sah kab*. Many darker gray voids of various sizes also are distributed throughout the clay body; these may pertain to the remnants of organic siccatives that carbonized during the firing process. Had the siccatives burned out completely, they would read as dark black spots, as those seen in other vessels. The recipe of this clay body, comprising both the vessel and its lid, seems distinct when compared with the other vessels surveyed by this project.

Cat. 20



Visible Reflected Light Photography, FCIR Imaging, and UVF Photography

Close observations performed at LACMA indicate that the artist utilized a complex, multifaceted technique of resist painting, layered polychrome engobes, and incised lines to decorate the surface of this vessel. The high-contrast detailing of each register was masterfully crafted by alternating layers of engobe with a thinned, liquid wax, resin, or other resist material, which burned off during firing and exposed the underlying, lighter engobes. This technique creates precise, controlled designs by applying sequences of colored paints and protecting specific areas with wax or resin detailing (i.e., resist painting) and, once fired, revealing an underlying design. This sophisticated technique required the artist to have the entire design in mind from the vessel's inception. Aside from the integration of resist painting, the engobes were applied in the traditional manner for Classic Maya ceramics, with the lightest engobes painted first (starting with a white primer) and the darkest engobes last. As can be seen in the detail image (fig. 5), the creamy white of the hand's thumbnail and other fingernails was the first color to be painted. Each nail was then covered in wax or resin before a thin coat of light orange engobe, which serves as the background color in most areas, was applied. The artist then used a resist material to create detailing in the glyphic text. Over this, a darker and more saturated red-orange engobe colored the vessel's upper and lower registers, as well as the hands and the rectangular cartouches. More wax or resin was then added to detail the palms of the hands and to preserve the red-orange forms of the glyph blocks. The last color added was black, which was applied only in certain areas already painted with the red-orange engobe, such as the upper and lower registers, the hands, and the rectangular cartouches. FCIR imaging indicates that this black engobe probably contains manganese-based pigments. As the final step, the artist incised the outlines of the glyphs, the hands, and the rectangular cartouches, cutting through the layers of colored engobe, as is evident in the detail image. The resist detailing and the incised decorations distinguish this vessel from the others assessed in this study. Under ultraviolet light, the base layer of white engobe—visible where outlines have been incised, as well as in the fingernails of the hands—has a luminous white fluorescence.

Fig. 5
Detail of hand showing the layers of engobe, resist technique, and incised outlines used to decorate this vessel

Cat. 20

Cat. 20

Cat. 20

Group 5

An Exemplary Tradition

Cat. 21

Cylinder Vessel with Maize God Dancers and Dwarf

Xultun or vicinity, Peten, Guatemala, 650–850 CE
Engobe-painted ceramic
Height: 6 3/8 in. (16.2 cm); diameter: 3 in. (7.6 cm)
Purchased with funds provided by Camilla Chandler Frost
M.2010.115.616
K5976

On this small cup, Maize Gods and a dwarf dance to celebrate the Maize God's rebirth and to inaugurate the world. Their movement around the vessel implies circular ritual motion related to creation and world renewal. This is a common scene for this painting style, centered in Holmul and Naranjo, Guatemala, but usually the Maize Gods and the dwarfs are paired. The artist here creatively accommodated the scene on this small cup without sacrificing meaning by painting one dwarf between two Maize Gods; he is effectively the dancing partner for both.

The painted inscription encircling the vessel's rim is the dedication statement, identifying it as a drinking vessel (*yuk'ib)* for chocolate whose owner is named Ixik Kaloomte' Ixik We'om Yohl Ch'een.[1] Also titled Ix Baax Witz Ajaw, she is a queen from Baax Witz, a toponym associated with Xultun or its vicinity.[2] The name and titles of this royal woman comprise a long passage that takes up half the vessel's circumference. Instead of shortening her name phrase because of the cup's small size, the painter abbreviated the dedication text, omitting the typical *utz'ihb* ([it is] the writing of) passage.

1 Sebastian Matteo and Guido Krempel, "La nobleza y el estilo cerámico de Xultun, Petén, Guatemala," in *XXIV Simposio de Investigaciones Arqueológicas En Guatemala, 2010*, eds. Bárbara Arroyo, Lorena Paiz, Adriana Linares Palma, and Ana Lucía Arroyave (Guatemala City: Museo Nacional de Arqueología y Etnología, Guatemala, 2011), 957–71.

2 Christian Prager, Elisabeth Wagner, Matteo, and Krempel, "A Reading for the Xultun Toponymic Title as B'aax (Tuun) Witz 'Ajaw 'Lord of the *B'aax-* (Stone) Hill,'" *Mexicon* 32, no. 4 (August 2010): 747–77.

Cat. 21

Studies of Manufacturing Techniques

X-Radiography

X-radiographs show a clay body worked with fairly coarse inclusions, which are visible as well-distributed points with a light gray tone. These, along with smaller, darker gray particles, may pertain to *sah kab* (marl). A number of larger dark voids likely correspond with burned-out or carbonized organic siccatives. The clay body is markedly similar to that of cat. 24, suggesting that the potters employed a similar process of clay preparation in the production of these two vessels.

Visible Reflected Light and Rollout Photography

The artist prepared the clay body for painting with a buff-colored primer (rather than the usual white), as is visible in the interior of the vessel (fig. 1). A layer of white engobe was then applied to the exterior surface, providing a luminous base for the red and orange engobes. Compared to the white background of "The Perfect Pot" (cat. 18), where there is considerable spalling, this engobe has remained well bonded to the underlying buff-colored primer. Analysis with pXRF shows that the primer is composed primarily of iron and potassium, suggesting the use of a potassium-based flux that would have allowed it to bond well with both the clay body and the white engobe. The use of sodium fluxes cannot be detected reliably with pXRF, as sodium is too light an element to be quantified using this method.

The artist rendered the glyphs and the painted scene using two colored engobes formulated to create two distinct optical effects: a translucent orange and a deep opaque red (fig. 2). Together, these engobes create a special two-tone effect. The figures and glyphs were first outlined with the red engobe, and then filled in with the translucent orange paint. In certain areas, such as the painted skin of the dancers, another layer of the opaque red engobe was applied over the orange in order to create contrast. Analysis with pXRF detected iron and titanium in both the red and orange engobes, suggesting the presence of rutile, a titanium oxide mineral used widely in ceramics that can vary in color from yellows to oranges and reds.

FCIR Imaging

The white engobe acquires a distinctive pink hue in FCIR. This same pink hue is also observed in cats. 23 and 24, which share the same style of red-on-cream surface decoration. Notably, its reflectance differs from that of the white used on "The Perfect Pot" (cat. 18), which has a slightly yellow rather than pink hue under this light. Analysis with pXRF identified silicon, aluminum, potassium, and calcium in this white engobe.

Fig. 1

Fig. 2
Detail highlighting the optical effects achieved by layering red and orange engobes

Cat. 21

Cat. 21

Cat. 21

UVF Photography

Under ultraviolet light, the pattern of the roots that grew on this vessel while it was interred fluoresces in luminous white.

Cat. 22

Cylinder Vessel with Water-Lily Serpent

Peten, Guatemala, possibly Tikal or Peten Lakes region,
700–800 CE
Engobe-painted ceramic
Height: 8 in. (20.3 cm); diameter: 4¹/₄ in. (10.9 cm)
Purchased with funds provided by Camilla Chandler Frost
M.2010.115.572
K1941

On this tall cylinder vessel, the artist painted a supernatural entity twice against a black background. Water signs in a band above that creature indicate a watery location, likely the primordial waters of creation or the aqueous entrance to the Maya underworld. Floating in this water is the Water-Lily Serpent, recognized by the serpentine face and the water lily emerging from its forehead. This supernatural entity appears often in Maya headdresses and impersonation phrases, which implies that elite people embodied this entity in ceremonial rites.

Encircling the upper rim is the vessel's dedication text, which names it as a drinking vessel for *yutal kakaw* (cacao food) for a royal woman from Mutal, the ancient name for the kingdom at Tikal, Guatemala, and affiliated sites. This royal woman bears the elevated *bakab* title. The text includes a rare verbal quadruplet—meaning there are four verbs as opposed to only one—dedicating this vessel for the royal woman.[3]

3 Dorie Reents-Budet et al., *Painting the Maya Universe: Royal Ceramics of the Classic Period* (Durham, NC: Duke University Press in association with Duke University Museum of Art, 1994), 158.

Cat. 22

Studies of Manufacturing Techniques

X-Radiography

As seen in the radiograph, the tall cylinder's relatively thin, even walls were formed by spiral coiling, which is faintly discernible in the horizontal pattern of the inclusions. The clay body was prepared with inorganic temper, visible as slightly coarse and evenly distributed white spots. Smaller, light gray points are also prevalent throughout the ceramic. These inclusions may pertain to a mixture of fine and coarse *sah kab*.

Rollout Photography

As with most other vessels, the first engobe to be applied was a white primer. The figures were then drafted with fine black lines, followed by a second sequence of black detailing, in this case with a bolder, darker line (see fig. 3). Then, red paint was added to give color to some areas. The artist painted the black background as the last step. In the detail image, the original contour line can be distinguished from the darker color of the background, which variably pools and ebbs across the surface of the vessel.

FCIR Imaging

In FCIR imaging, the layering and burnishing of the black engobe becomes evident. The reddish-brown hue of the black engobe, especially visible for the contour lines as well as where the background coverage is thinnest, indicates a manganese-based engobe. The iron-based red engobe shifts to yellow. A series of amorphous black spots and more expansive deposits, which reflect opaque black in FCIR, pertain to a crust formed in the burial environment (fig. 4).

Fig. 3
Detail highlighting the sequence of painting. Note the different sequences of black detailing and the overlapping red engobe in some areas.

Fig. 4
FCIR detail illustrating the black deposits that formed in the burial environment

Cat. 22

Cat. 22

Cat. 23
Cylinder Vessel with Water-Lily Serpent

Río Azul or Xultun or vicinity, northern Peten, Guatemala, 650–850 CE
Engobe-painted ceramic
Height: 9 3/4 in. (24.9 cm); diameter: 4 in. (10.2 cm)
Purchased with funds provided by Camilla Chandler Frost
M.2010.115.844
K7459

Painted twice on this vessel are two heads of the Water-Lily Serpent, oriented diagonally, as if floating in the primordial waters of creation, in a manner similar to the heads on other vessels (see cats. 18 and 22). The painter applied strong lines of orange-red engobe to create the clear lines of the Water-Lily Serpent and texts, and also applied orange, though more diffusely, around the images and text to highlight them, thus producing an effect conveying a sense of emitted light or energy.

There are two sets of texts: the dedication text that encircles the rim, and the two diagonal texts placed between the supernatural heads. The dedication text names it as a vessel for *tzih* (fresh), possibly an abbreviation for fresh or pure chocolate, and one that is seen on other vessels from the Xultun region in Guatemala.[4] The owner is named as *chak ch'ok* (great youth), among other epithets; this beautifully executed vessel is thus part of a phenomenon of commissioning polychrome vessels for elite young men.[5] The diagonal texts contain a phrase that functions as a scribal signature. The artist is referred to as *its'aat* (wise person), and at the end of the second diagonal text, the title 13 *tzuk* (which was used by nobles in Río Azul and Xultun) appears, suggesting an origin for this vessel in one of those two sites, or in the region.[6]

4
David Stuart, "The Language of Chocolate: References to Cacao on Classic Maya Drinking Vessels," in *Chocolate in Mesoamerica: A Cultural History of Cacao*, ed. Cameron L. McNeil (Gainesville, FL: University Press of Florida, 2006), 184–201.

5
Stephen D. Houston, "A Splendid Predicament: Young Men in Classic Maya Society," *Cambridge Archaeological Journal* 19, no. 2 (June 2009): 149–78.

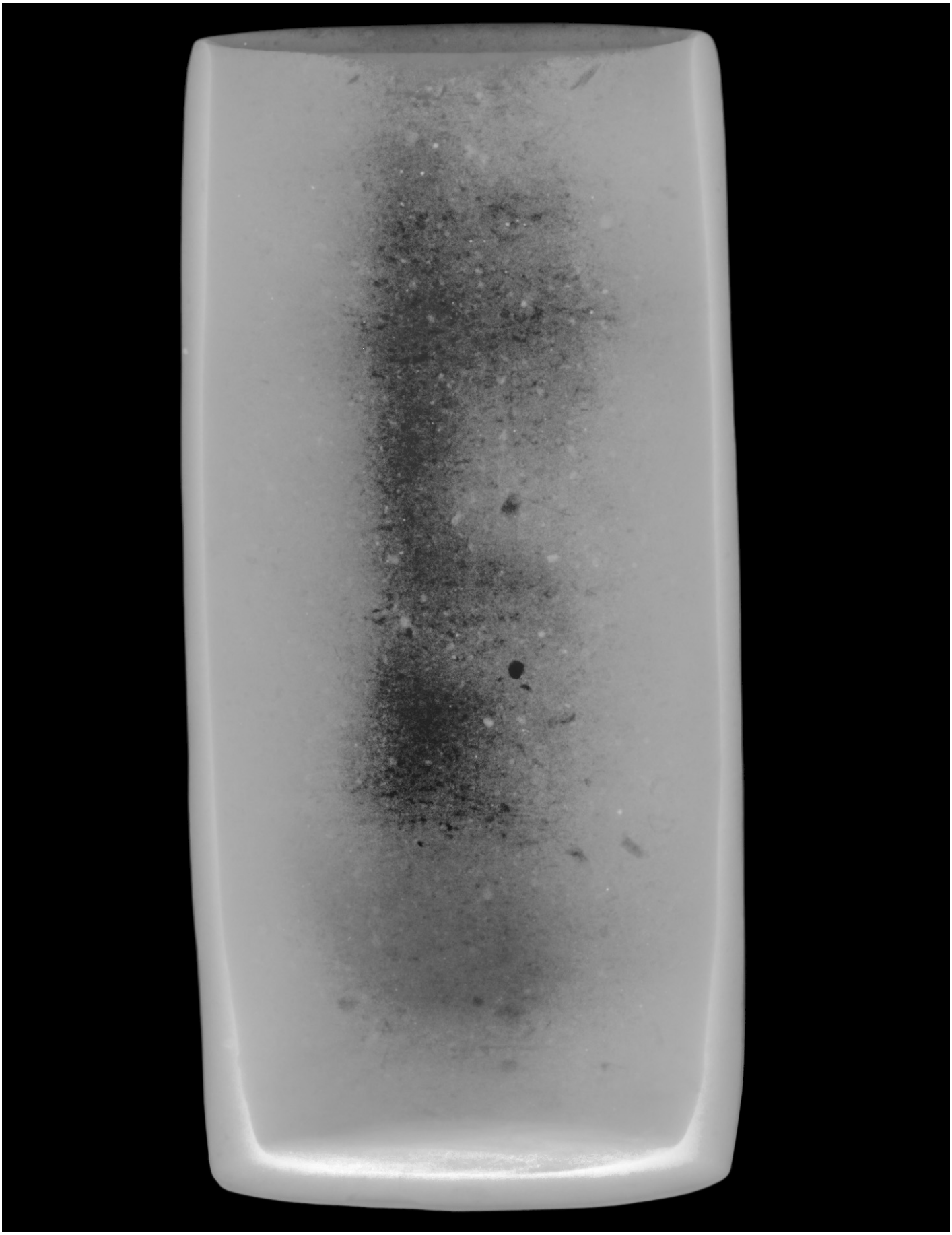
6
Alexandre Tokovinine, "The Power of Place: Political Landscape and Identity in Classic Maya Inscriptions, Imagery, and Architecture," PhD diss. (Harvard University, 2008), 252; Matteo and Krempel, "La nobleza y el estilo cerámico de Xultun, Petén, Guatemala," 957–71; Krempel and Matteo, "Painting Styles of the North-Eastern Petén from a Local Perspective: The Palace Schools of Yax We'en Chan K'inich, Lord of Xultun," in "Proceedings of the 1st Cracow Maya Conference: Archaeology and Epigraphy of the Eastern Central Maya Lowlands," eds. Christophe Helmke and Jarosław Żrałka, special issue, *Contributions in New World Archaeology* 3 (2012): 135–72.

Cat. 23

Studies of Manufacturing Techniques

X-Radiography

X-radiographs show that the clay body was prepared with a mix of organic siccatives and inorganic temper. As can be observed in the image, the dark voids of burned-out organic matter occur in the same sizes and distribution as the light gray flecks of inorganic temper, which may pertain to *sah kab*. The vessel's walls are widest at the bottom and taper as they extend upward, leaning slightly to one side; these traits are characteristic of spiral-coiled vessels.



Cat. 23

Rollout Photography

The artist rendered the Water-Lily Serpent motifs and the glyphs with a single opaque red engobe over a white base. The matte opacity of this engobe contrasts sharply with the vitreous quality of the red engobe used in “The Perfect Pot” (cat. 18). While the engobe has the same color, it is the result of a different recipe. Compared with that of the “The Perfect Pot,” this engobe likely has less flux and, thus, is less vitreous. Additionally, in contrast with cats. 21 and 24, this vase exhibits a single colored engobe that has been diluted to achieve different shades. For example, a very diluted form of the red engobe was utilized to create the clouds of color that appear to emanate from the motifs (fig. 5).

FCIR Imaging

In FCIR, the white engobe used to paint the background reflects a similar pink hue as that seen in cats. 21 and 24. As noted in cat. 21, this differs from the reflectance of the white engobe used in “The Perfect Pot” (cat. 18), which takes on a slightly yellow tone. Notably, as is particularly apparent in the FCIR image (fig. 6), the aggregates were not well attached to the clay body and left tiny holes where exposed on the vessel’s surface.

Fig. 5
Detail of a Water-Lily Serpent motif rendered in a matte red engobe, and emanating clouds painted with a diluted form of the same engobe

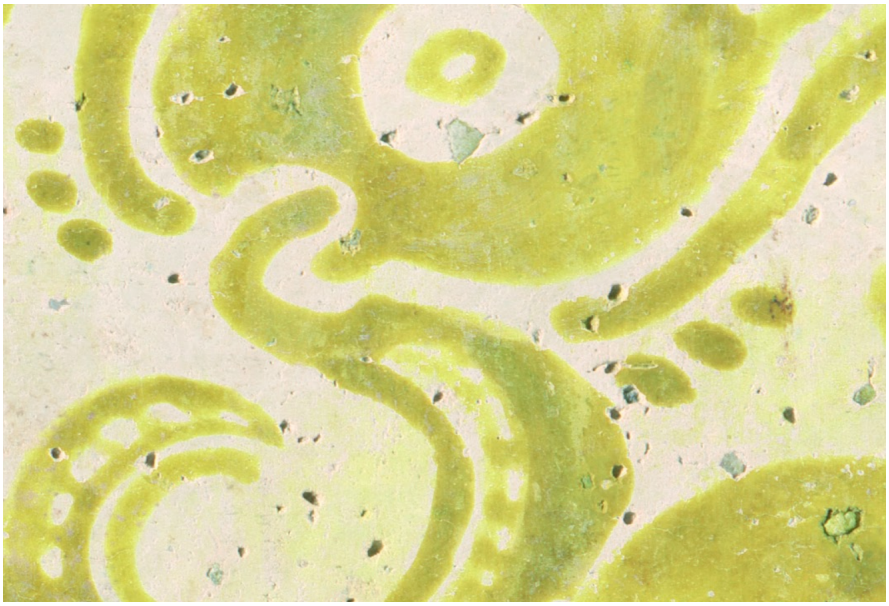
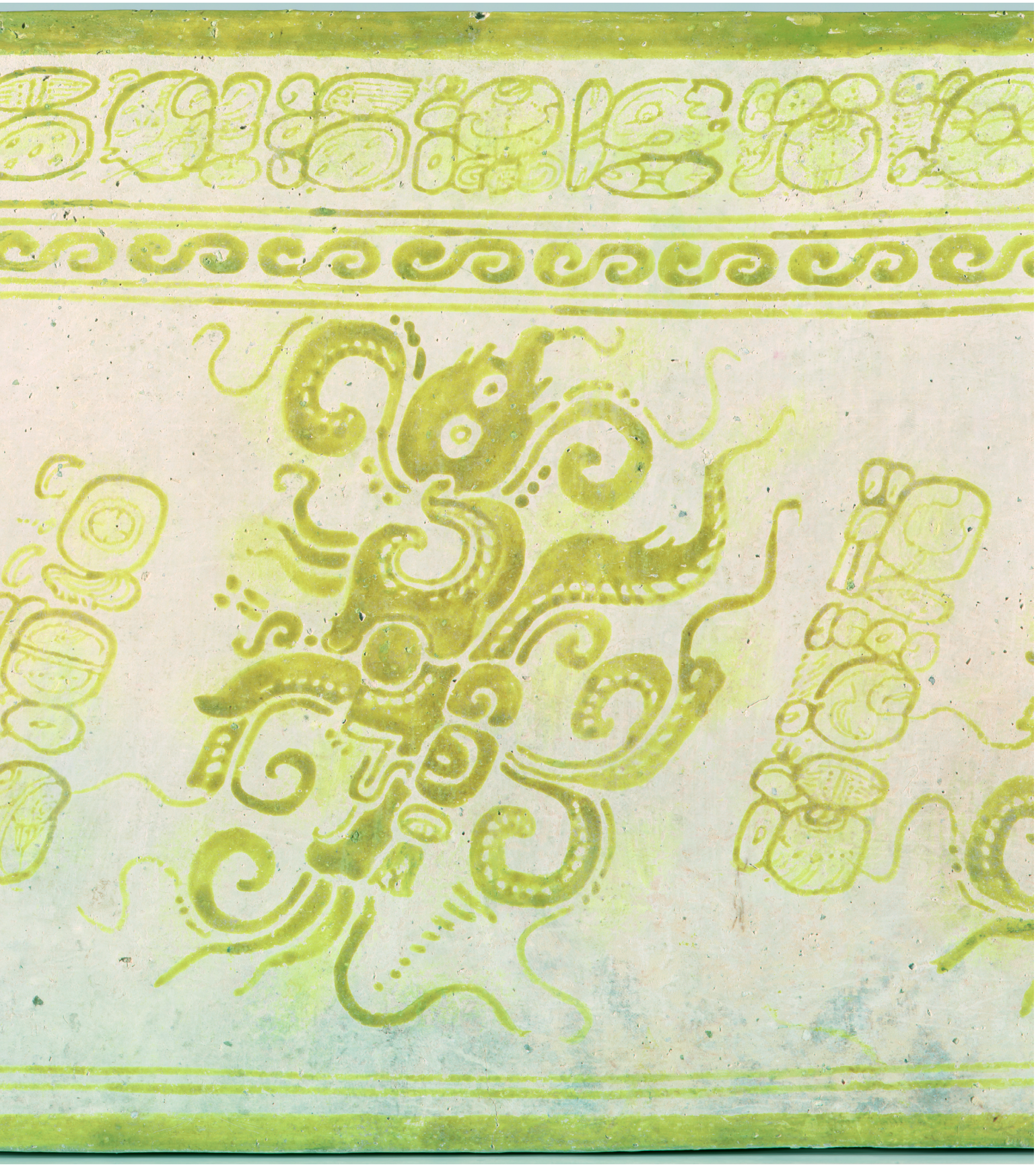


Fig. 6
FCIR detail highlighting the loss of aggregates visible from the surface of the vessel

Cat. 23

Cat. 23



Cat. 24

Cylinder Vessel with Maize God Dancers and Dwarfs

Naranjo or vicinity, Peten, Guatemala, 650–850 CE
Engobe-painted ceramic with postfire pigment
Height: 9 3/8 in. (23.8 cm); diameter: 3 7/8 in. (9.7 cm)
Purchased with funds provided by Camilla Chandler Frost
M.2010.115.495
K3400

Featured on this cylinder vessel are two Maize Gods with dwarfs, a common scene for this painting style centered at Holmul and Naranjo, Guatemala.[7] Portrayed frontally or in profile, the Maize Gods and dwarfs are dancing. In each vignette, one member of the pair's hands or feet is raised or lowered, suggesting motion, as if there were only one supernatural pair shown at two points in time. Both depictions of the Maize God wear feathered backracks with skybands and supernatural birds at the top. Inside are stone thrones or mountains—the mountains of creation—with a seated water-lily jaguar and a reptile, respectively. The supernatural entities dance to celebrate the Maize God's rebirth and to inaugurate the world.

The vertically oriented inscriptions retain the thin red guidelines the artist used to order the texts (fig. 7). They name particular manifestations of the Maize God that were associated with supernatural locations correlating with the creatures in the backracks; specifically, the reptile is associated with Wak Chan Nal (6 Sky Corn), and the jaguar with Wak Hix Nal (6 Jaguar Corn).[8] They also include references to K'uhul Mutal Ajaw and K'uhul Kaanul Ajaw, the Late Classic (600–800 CE) emblem glyphs of Tikal and Calakmul, respectively.[9]

7
Reents-Budet, "The Holmul Dancer Theme in Maya Art," in *Sixth Palenque Round Table, 1986*, ed. Virginia M. Fields (Norman, OK: University of Oklahoma Press, 1991), 217–22.

8
Matthew Looper, *To Be Like Gods: Dance in Ancient Maya Civilization* (Austin: University of Texas Press, 2009), 120; Tokovinine, *Place and Identity in Classic Maya Narratives* (Washington, D.C.: Dumbarton Oaks Research Library and Collection, 2013), 116.

9
Tokovinine, *Place and Identity in Classic Maya Narratives*, 116–18.

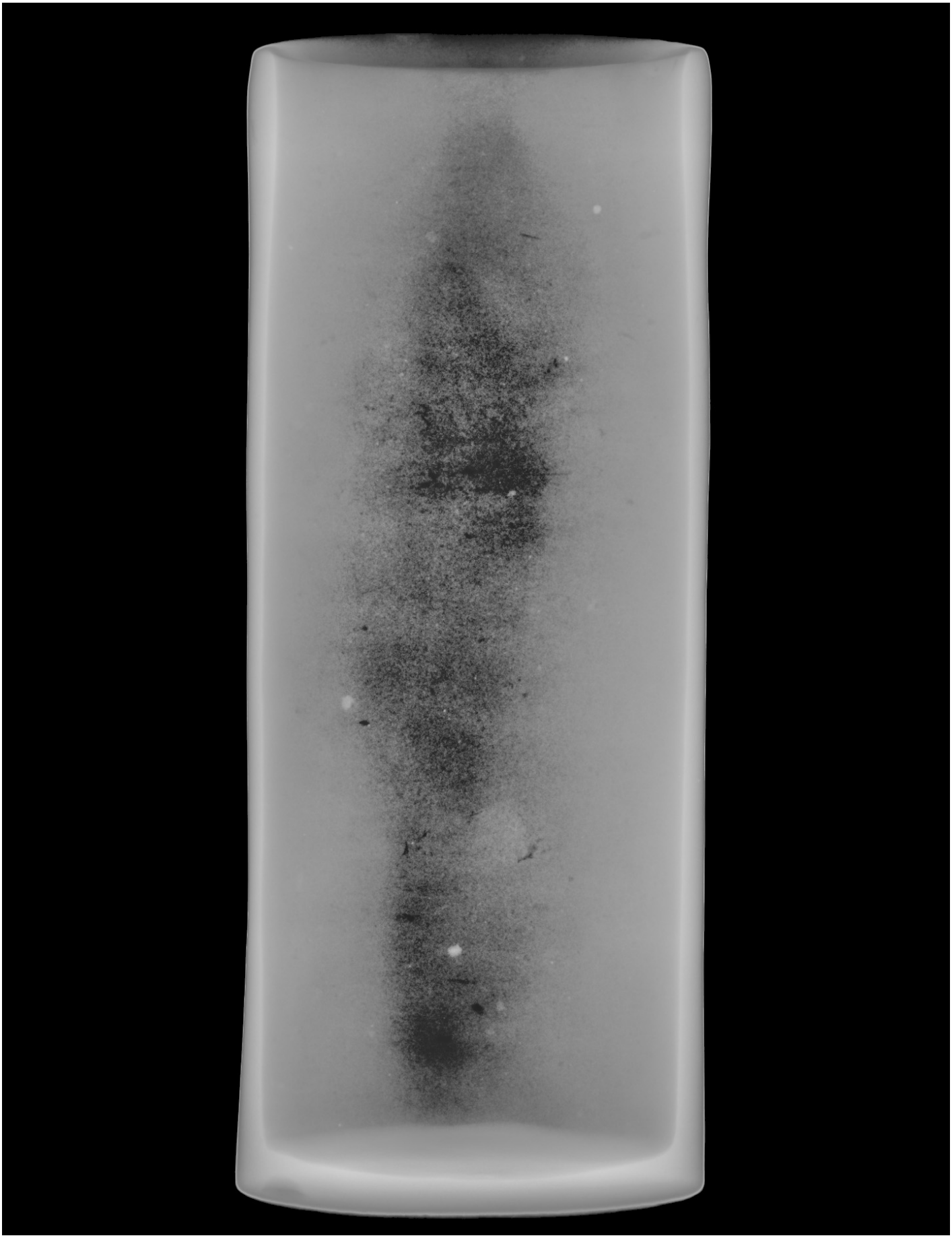
Cat. 24

Studies of Manufacturing Techniques

X-Radiography

X-radiography indicates the clay body has been worked with slightly coarse inorganic temper that is consistent and evenly distributed. This temper, which registers as light gray flecks on the radiograph, likely pertains to coarse calcareous marl or *sah kab*.[10] The coarse and consistent nature of these inclusions mirrors that seen in the clay body of cat. 21, suggesting that the potters of these two vessels prepared the clay in the same or in a similar fashion. The floor and walls of the vessel were hand built with coils. The thickness of the walls varies considerably, which can perhaps be attributed to the difficulty that the vessel's tall and constricted form imposed on shaping the clay.

10 Dean Arnold, *Maya Potters' Indigenous Knowledge: Cognition, Engagement, and Practice* (Boulder, CO: University Press of Colorado, 2018), 96–97.



Cat. 24

Rollout Photography

As is typical of Maya ceramic painting, the first layer to be applied was a white primer, followed by a cream-colored engobe. This cream engobe serves as the base for the figural scene, which was rendered with two iron-based engobes, a dark red and an orange. The painter used these two formulations to paint the figures in a manner similar to that observed for cat. 21: first, the dark red contour lines, and then the lighter orange fill, followed by a second application of the dark red engobe (primarily to the dancers' skin). In contrast to cat. 21, however, here, black detailing—rendered with a manganese-based engobe—was added to the composition to enhance the garments of the dancing dwarfs. At the base of the vessel, traces of postfire-applied blue pigment, which may pertain to a dark shade of Maya blue, can be seen (fig. 8).

FCIR Imaging

In FCIR, the red and orange engobes shift to yellow. As confirmed by pXRF analysis, the mineral colorants of both of these engobes are iron based. And as observed for cats. 21 and 23, the cream background color of this vessel shifts to pink, possibly indicating the use of calcium as a whitening agent. Close observation of the black detailing of the dwarfs' garments reveals two layers of pigment (fig. 9). The first corresponds with the original engobe, which acquires a reddish-brown hue that suggests the use of a manganese-based colorant. The second corresponds with modern repaint, which has a green tone in FCIR. The traces of blue postfire-applied pigment at the base of the vessel refract dark pink, which may indicate the presence of indigo and therefore Maya blue.

Fig. 7
Detail showing the red guidelines used to arrange the vessel's glyphic text

Fig. 8
Detail highlighting the polychrome palette of the vase. Note the traces of blue pigment in the lower left-hand corner.

Fig. 9
FCIR detail highlighting the two layers of black pigment in the dwarf's garment. Note the dark pink hue of the postfire-applied pigment, which can indicate the use of Maya blue.

Cat. 24

Cat. 24

Cat. 25

Cylinder Vessel with Hunal *Motif*

Peten, Guatemala, possibly Xultun or vicinity, 8th century
Engobe-painted ceramic
Height: 6 3/4 in. (17.1 cm); diameter: 3 1/8 in. (7.9 cm)
Purchased with funds provided by Camilla Chandler Frost
M.2010.115.790
K7055

Painted twice on this small cup is the *hunal* motif, an entity appearing on Maya royal headbands and a distinct symbol of rulership, here with aspects of the lightning deity K'awiil.[11]

The dedication text encircling the upper rim names the owner as a royal woman—ixik ajaw (Lady Lord)—who is identified as *uchan ch'ok* (guardian of the youth), perhaps because she was the governess of a young prince.[12] Sebastian Matteo and Guido Krempel associate this vessel with nobles from the undiscovered Yootz site and propose it and others with similar calligraphy were made in the pottery workshops of Yax We'en Chan K'inich, a ruler of Xultun, Guatemala. They also note the relationships of Yootz with Xultun. The *hunal* motif appears on other vessels dedicated to Xultun nobles.[13]

11
Krempel and Matteo, "Painting Styles of the North-Eastern Peten from a Local Perspective," 11, 135–72.

12
Houston, "A Splendid Predicament: Young Men in Classic Maya Society," 149–78; Houston and Simon Martin, "Let Thy Glyphs Be Few: Abbreviations in Maya Writing," *Maya Decipherment: Ideas on Ancient Maya Writing and Iconography* (blog), January 16, 2011, https://decipherment.wordpress.com/2011/01/16/let-thy-glyph s-be-few-abbreviations-in-maya-writing/.

13
Matteo and Krempel, "La nobleza y el estilo cerámico de Xultun, Petén, Guatemala," 957–71; Krempel and Matteo, "Painting Styles of the North-Eastern Peten from a Local Perspective," 135–72; Krempel and Matteo, "A Maya Vessel Dedicated to Yax We'en Chan K'inich, Lord of Xultun, Guatemala," *Mexicon* 35, no. 1 (February 2013): 11–14.

Cat. 25

Studies of Manufacturing Techniques

X-Radiography

A series of dark ovoid shapes, distributed unevenly throughout the vessel, indicates the incorporation of organic siccatives into the clay body. Inorganic temper like *sah kab* may correspond with the uneven distribution of gray flecks faintly visible in the radiograph, but the weak contrast in particles makes this determination difficult. As the radiodensity of the inorganic temper is similar to that of the clay body, *nooy* is a potential candidate (see cat. 8). The unique formulation of the clay body, along with the vessel's iconographic style, suggests that this vessel emerged from a distinct ceramic workshop. More research comparing this vessel with similar examples associated with the Yootz site will help further elucidate the nature of this tradition.

Cat. 25

Rollout Photography

The dark red engobe comprising the background color is remarkably thick and opaque. Close observation reveals that the painter applied this engobe in crude strokes that often impinge on the black contour lines of the figures (fig. 10). This contrasts starkly with the other vessels surveyed by this project; in those other examples of Classic Maya (250–900 CE) ceramic painting, the figural outlines, with their calligraphic quality, are never overwritten by the background color so markedly. Technical imaging additionally displays a degree of modern repaint in this red background (see discussion of FCIR imaging below). These characteristics reflect a tradition with different aesthetic values and technical knowledge. Thus, this vessel and its study help to further connoisseurship of Classic Maya painted ceramics.

FCIR Imaging

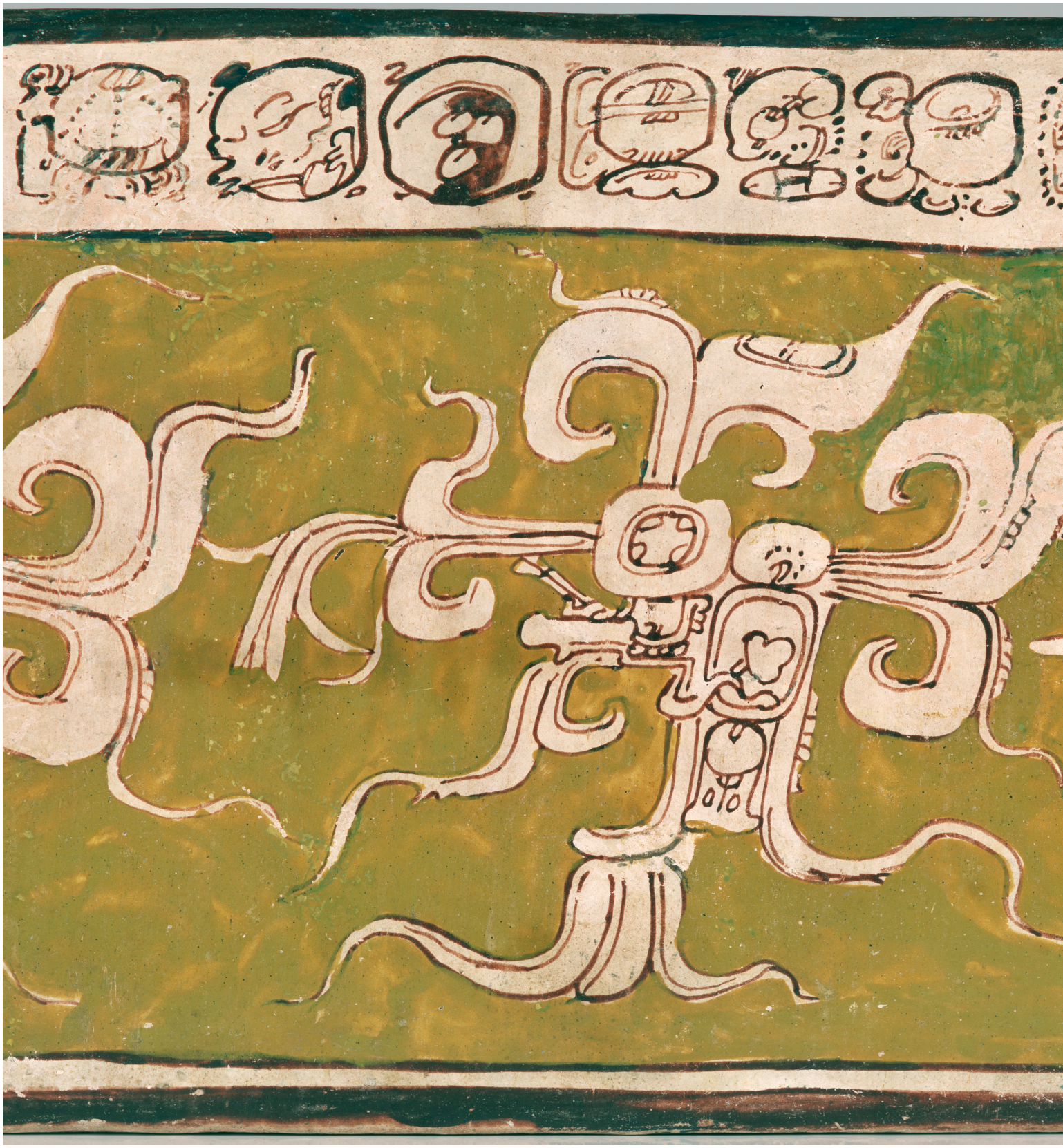
The thick red engobe acquires a dark mustard color in FCIR. This implies a distinct pigment or recipe used to prepare this engobe when compared with the reds of the other surveyed vessels, which acquire a lighter, yellow hue. Instances of modern repaint over the red background appear green. FCIR imaging also makes evident modern interventions in the black contour lines, which have an opaque black or dark green hue in contrast with the reddish-brown reflectance of the original engobe (fig. 11).

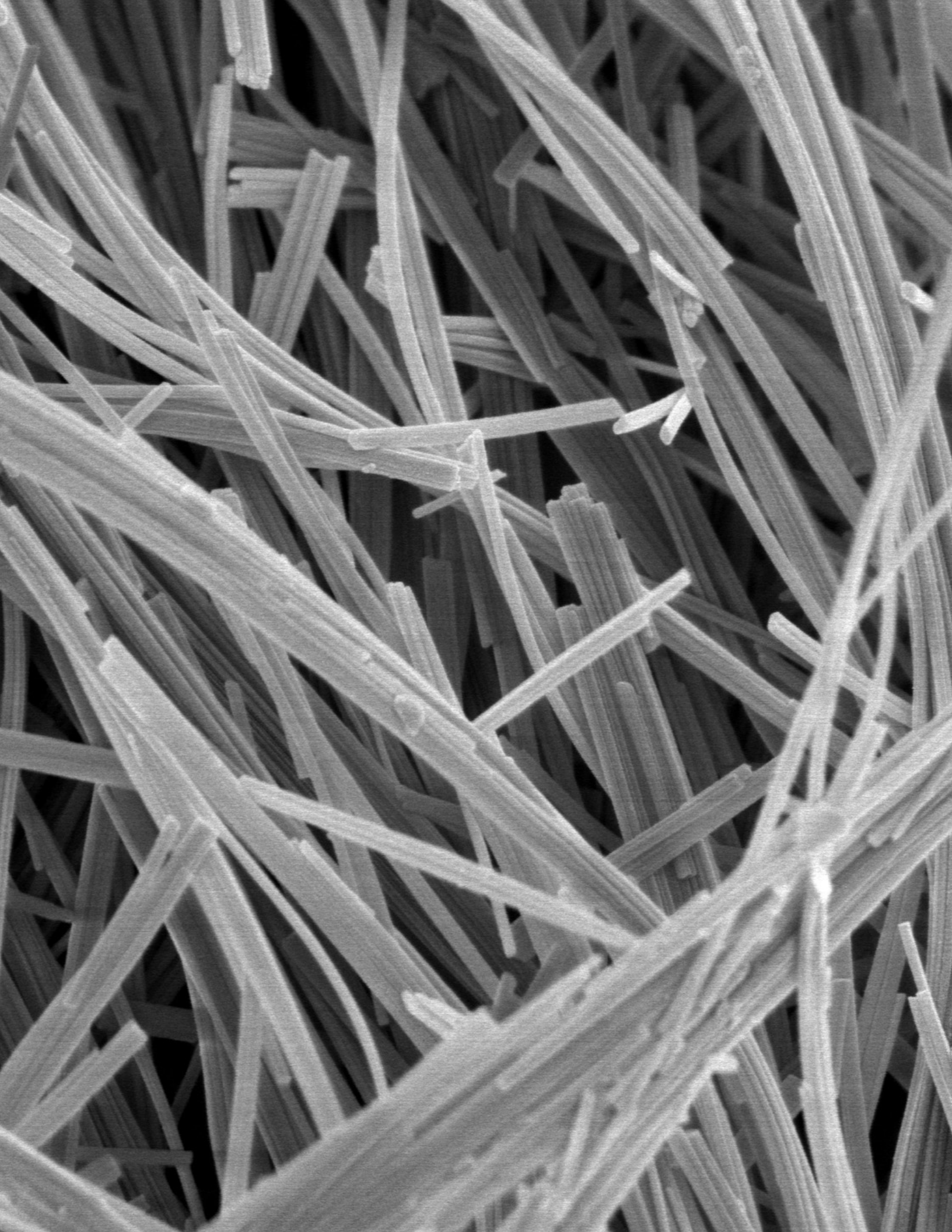
Fig. 10
Detail highlighting the crude strokes of the thick red engobe and the disregard for the black contour lines

Fig. 11
FCIR detail highlighting modern interventions, namely the repaint in the red background (green) and in the contour lines of the vessel's figures (opaque black or dark green, as opposed to the reddish-brown hue of the original engobe)

Cat. 25

Cat. 25





7 From a Karst Landscape to Majestic Vessels: Reconstructing Ancient Maya Ceramic Practices

John W. Hirx

Maya potters of antiquity faced three challenges: how to harness the natural clay resources in their environment to create ceramic masterpieces; how to design and develop a palette of ceramic paints, or engobes, with which to render their pictorial tableaus; and how to get their masterworks through a firing cycle without blemish or damage. The vessels they left behind attest to their success. To investigate the ways in which the Maya approached those issues, this essay combines an understanding of the chemical and physical properties of clay with technical analysis of ancient pottery and knowledge of contemporary ceramic practices.

The Maya Potter's Approach to Clay-Body Development

Clay encompasses a large family of minerals that vary in size, shape, crystalline habit, chemistry, and physical properties. They result as products of the hydrothermal alteration and precipitation of igneous rocks, which form as magma or lava cool. Some clays remain at the site of their origin while wind and water relocate others. Primary clays weather in situ and are relatively free of organic and inorganic impurities—for instance, the famous white-burning kaolin of China. The Yucatan Peninsula's karst landscape, eroded and shaped by the dissolution of limestone and other calcareous (calcium-carbonate-containing) minerals, hosts clay sources that Maya potters have mined for millennia. Lenticular layers of various clays intercalated within a calcareous matrix likely formed in place as alteration products of volcanic ash, which has been identified in clay samples collected from the region.[1]

Regardless of their origin and mechanisms of formation, all clays fall into the category of phyllosilicates: Their particles, due to their flat or rodlike shapes, can glide past one another, imbuing clays with the workable property of plasticity. Potters select clays based on the final temperature to which they will be fired, their color after firing, ease of workability, and the desired visual and physical properties of the fired wares. In the process of prospecting clays, potters rely on their senses and indigenous memories. They smell their materials, taste them, and carefully examine and feel them to determine which best meet the requirements of their finished products.[2] Ancient Maya potters were sommeliers of clays.

Rarely, a ceramicist may find a singular, naturally occurring clay with characteristics suitable for direct use in pottery; usually, clay requires processing and modifications. Processing begins with flotation, during which a clay worker breaks down clumps of clay, dispersing them in settling tanks filled with water. As the clumps soften, rocks and pebbles descend to the bottom, while organic matter, such as leaves and roots, rises to the top, allowing the ceramicist to skim it from the tank. The clay worker then transfers the resulting slurry, called slip, to another tank, leaving the rocks and pebbles behind. To create a clay body, the potter must then extract excess moisture from the slip, either by leaving it in the tank or by placing it on an absorbent surface and allowing it to dry in the sun to a workable consistency. The working consistency is directly related to the clay body's drying characteristics as well as its ability to withstand a firing cycle without damage.

When clay has dried to a workable consistency, potters incorporate additives to modify its properties. The word "temper" refers to both organic and inorganic nonplastic inclusions added to a clay body to amend its shortcomings or enhance its natural properties. Sticky clays become less sticky with nonplastic organic siccatives, such as seeds or chopped grass. During the firing process, these materials can either burn out when the kiln atmosphere is in an oxidizing state, or, if the firing environment is in a reducing state, the organic material reduces to elemental carbon and remains

1 Dean E. Arnold, *Maya Potters' Indigenous Knowledge: Cognition, Engagement, and Practice* (Boulder, CO: University Press of Colorado, 2018), 81.

2 Ibid., 81.

in the clay body. Inorganic nonplastic inclusions include fired and ground ceramic (known as grog), quartz and feldspathic sands, or even volcanic ash. The role of these materials is manifold. Since they have already endured a thermal sequence—whether through previous firing, as with grog, or geologic processes—they confer thermal shock properties on the clay body, increasing the wares' capability of passing through firing without cracking or exploding.

Dean E. Arnold has noted that modern potters in Ticul, in the Mexican state of Yucatan, prospect various clays and additives in their local environments—a practice likely inherited from their ancient predecessors.[3] The contemporary Yucatec Mayan language refers to each of these materials with specific names. Over the course of Arnold's study of Indigenous potters, researchers analyzed samples of clay types using x-ray diffraction (XRD), an analytical technique that can identify the unique crystalline structures of individual clay minerals. The Yucatec word for clay, *k'at*, describes a blend of the clay minerals kaolinite and smectite (formerly montmorillonite). *Sak lu'um*, translated as "white earth," refers to palygorskite (also called attapulgite). Marl, a rock or soil composed of clay and variable carbonate minerals, constitutes the primary additives to the clay body used by these potters. Yucatec Mayan differentiates marl into two categories, both of which contain palygorskite, calcite, and dolomite: coarse, hard *sah kab* and fine, powdery *nooy*.

Though these clays share chemical similarity, they form through different geologic processes that result in distinct crystalline habits and composition ranges. Each clay thus exhibits individual properties. For instance, kaolinite particles take the shape of flat, hexagonal plates stacked like a deck of cards (fig. 1).[4] Palygorskite crystallizes into narrow, rodlike shapes reminiscent of fiberglass (fig. 2).[5] Potters likely recognized these differences by the feel of the clays and capitalized on their physical and thermal properties by observing the characteristics of their finished wares. The use of palygorskite in the clay body, for instance, would result in a lightweight vessel with high tensile strength despite firing in a low-fire environment. Furthermore, the shape of palygorskite particles allows for close packing, producing a dense clay body that, once fired, prevents the ingress of water and salts in a burial environment. The use of smectite in ceramic paints likely takes advantage of the fact that the individual platelets easily slide past one another, forming a thin opaque film rather than discontinuous clumps.[6] Such specific uses of materials in applications suited to their characteristics suggest that Maya potters experimented, developing preferences that align with the properties of individual clays.

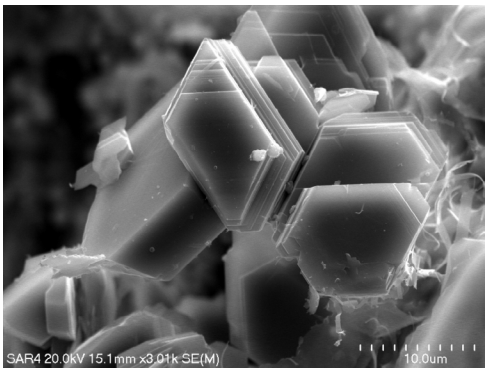


Fig. 1
Kaolinite Weissliegend sandstone from the Fore-Sudetic Monocline (photograph courtesy of Michal Skiba, Institute of Geological Sciences, Jagiellonian University, Kraków)

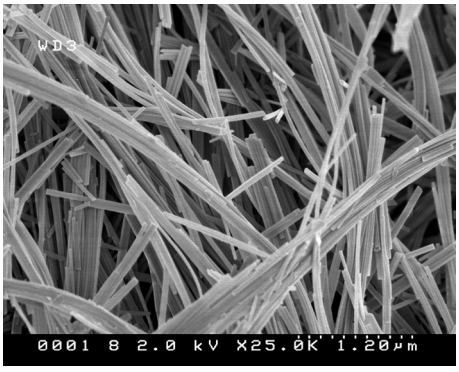


Fig. 2
Palygorskite from Jizda, Kazakhstan (photograph courtesy of Toshihiro Kogure)

3
Ibid.

4
Prudence M. Rice, *Pottery Analysis: A Sourcebook*, 2nd ed. (Chicago: University of Chicago Press, 2015), 52.

5
Ibid., 57.

6
XRD analysis confirmed the presence of smectite in the ground layer of engobe on a sherd at New York's Metropolitan Museum of Art; Federico Carò, personal communication, 2018.

Marl functions in a manner similar to the previously noted inorganic tempers. It shares with them the property of hardness, which helps control shrinkage of the clay as it dries. However, unlike grog, it contains unfired palygorskite clay mixed with carbonates. The carbonate component can vary mineralogically (for instance, carbonates of calcium or magnesium). During firing, the carbonate decomposes to a gas and volatilizes from the clay body, leaving calcium or magnesium behind. These elements act as fluxing agents, which allow the clay to fuse, lending hardness to the finished vessel. The combination of clays and additives thus compounds a clay body that fires to a dense ware as the particles fill space within the clay body and cause point sintering. As mentioned above, the density of the ware has long-term ramifications for preservation.

Slip vs. Engobe

Slip, the clay slurry obtained through the process of flotation described above, constitutes a suspension of colloidal clay particles in water—the particles do not dissolve but are small enough to remain dispersed in the water without settling.[7] Potters can deplete slip of water to make a clay body or keep it as a liquid suspension for other uses, such as joining coils, slabs, or other parts of a vessel. Ceramicists also transform slips into painting materials through trial and error, adding substances that help control key physical and thermal properties of the resulting ceramic paints. This book distinguishes between unadulterated slips (clay and water) and engobes, or slip-based ceramic paints.

Borrowing the word for "slip" from Romance languages, American academics adopted and adapted the term "engobe" around 1950. It appears in textbooks by Glenn C. Nelson, University of Minnesota, Duluth; Susan Peterson, Hunter College, City University of New York; and Daniel Rhodes, Alfred University, New York, all of whom taught studio ceramics.[8] They employ the word as new nomenclature to denote the use of clays that are designed, modified, or engineered to exhibit controllable, repeatable properties. The word "engineering" derives from the Latin *ingenium* (cleverness) and *ingeniare* (to contrive or devise). Artists typically develop engobes to cover a clay surface with a suitably dense coating of a desired color, both optically and physically. These ceramic paints need to remain bonded to the surface during drying, shrinkage, and firing. Often, they are formulated to vitrify and harden at a temperature similar to, or lower than, that required by the clay body to which they are applied.[9]

In order for Maya vessel painters to create their compositions, they had to empirically develop a broad palette of colored engobes that varied in terms of value, hue, and opacity. Maya artists included among their ranks accomplished mural and manuscript painters. Familiarity with ink and paint behavior from those art forms may have guided Maya potters in their manipulation of ceramic paints. Perhaps armed with that knowledge, they sought to develop engobes that behaved like inks or paints in terms of flow, covering power, color, and thickness. The degree of manipulation needed to create such a palette supports the identification of these ceramic paints as engobes rather than slips.

Maya clay workers likely lacked analytical knowledge of whether they were working with a sodium- or calcium-rich clay. More likely, over many generations, they found a few beds of clay in which they prospected, learning to manipulate their natural properties—perhaps one burned white, another reddish-brown. They modified their clays with numerous substances to produce paints that range from matte and saturated to glossy and translucent. In addition to using metallic pigments to provide color

7 F. H. Norton, *Ceramics for the Artist Potter* (Cambridge, MA: Addison-Wesley, 1956), 72.

8 Glenn C. Nelson, *Ceramics: A Potter's Handbook*, 2nd ed. (New York: Holt, Rinehart and Winston, 1966); Susan Peterson and Jan Peterson, *The Craft and Art of Clay* (1992), 4th ed. (Woodstock, NY: Overlook Press, 2003); Daniel Rhodes, *Clay and Glazes for the Potter* (Philadelphia: Chilton, 1973).

9 Rhodes, *Clay and Glazes for the Potter*, 250.

and siliceous fluxes to promote fusing, resulting in glossy surface finishes, Maya artists incorporated alkaline deflocculants into their engobes to prevent clumping. These electrolytes, typically sodium or calcium hydroxides, act on clay particles to cause them to repel one another. The repulsive force induced by deflocculants acts as a lubricant between clay particles, which decreases the need for water, resulting in less shrinkage and a higher concentration of media.

Aspects of the artistic process also would have influenced the formulation of engobes. Artists may have painted a vessel over the course of multiple sittings. An engobe painted onto a wet or leather-hard surface may have fired very differently from one applied to a dry or bisqued surface.[10] Therefore, the engobes used by the Maya may have had a very low calcined-clay content—just enough for them to stick to a dry vessel.[11] The reduced clay content would have decreased shrinkage during drying; otherwise, the painting would have fallen off the pottery. The multitude of ceramic variables explored by Maya potters over generations inevitably underscores their achievement of creating a spectacular palette of colored engobes, which they used to create masterful, error-free pictorial tableaus.

Imagining Ancient Maya Firing Practices

The conversion of clay to ceramic requires a firing environment. The environment can be short-lived and temporary or relatively permanent, staying in use for many years. Kilns provide a familiar example of the more-permanent variety. During the ancient, historic, and modern eras of many cultures, potters fired kilns on a periodic basis when full. The construction of these kilns typically made use of durable ceramic materials that could withstand many firings.

Archaeologists have found numerous ancient kilns during excavations. Nevertheless, for several cultures that produced seemingly important ceramics for their royal courts, including the Maya, no kiln evidence survives. Unlike the works produced in the large imperial kilns of China that generated thousands of identical porcelains for the court, the superbly painted Maya vessels seem to exist primarily as singular items, though occasionally in pairs or sets.[12] Shapes, however, repeat. Just as Maya potters engineered their clay bodies and engobes, they also had to develop reproducible, controllable firing practices that resulted in flaw-free finished vessels. For insight regarding the kind of firing environment they used, researchers may consider exploring the traditional indigenous knowledge of analogous contemporary cultures.

Ethnographic studies of modern-day Indigenous artists in North America, such as the studio potter Susan Peterson's documentation of the practices of the Native American ceramicist Maria Martinez and Arnold's anthropological research on Maya potters in Ticul, offer clues to the firing methods used by the ancient Maya.[13] Both authors show potters who have mastered the use of temporary firing environments. In the case of Martinez, Peterson documented the firing method in photographs. Martinez never used a kiln. She fired all of her wares in an open bonfire. In his book, Arnold includes pictures of temporary kilns used by Maya potters in the 1960s. He interviewed many potters to understand their traditional Indigenous-knowledge base so he could document their approach to firing methods. These potters created distinct firing environments for specific circumstances: either to fire a certain number of figures, to produce a certain number of pots, or even to ensure that the fired items would generate a certain amount of income.

As previously noted, archaeologists typically uncover evidence of ceramic manufacturing in the form of kilns made from fired bricks, kiln furniture (such as

10 Peterson and Peterson, *The Craft and Art of Clay*, 111.

11 Nelson, *Ceramics*, 323.

12 See Mary E. Miller, "The Trouble with Sets: Renewing the Contexts of Maya Vases," in this volume.

13 Susan Peterson, *The Living Tradition of Maria Martinez* (1977), new ed. (Tokyo: Kodansha International, 1989); Arnold, *Maya Potters' Indigenous Knowledge*.

shelves and posts), and waster heaps of ceramic rejects. Arnold shows a diagram of a round temporary kiln, a modified beehive updraft style, made from two concentric circles of irregularly shaped stones placed on the ground with openings on one end (fig. 3). Typically, the opening faces west, but its orientation can vary depending on wind direction. Potters place the wares between the circles. This double-walled firing environment serves to insulate and regulate the temperatures in the kiln. All firing environments leak heat, and the temperature varies from place to place. The Maya potters accommodate this variation in part through the type of marl they add to the clay body, discussed above. The particle size of the coarse *sah kab* and fine *nooy* seems to have an effect on the ware during firing. Potters determine which to include while working a particular clay body depending upon whether the resulting vessel is to be placed in a hotter or cooler area of the kiln.

To construct their kilns, modern Maya potters (as did their ancestors) use a form of limestone held in place with clays and plasters. They stack the stones concentrically, setting each subsequent row slightly toward the center to taper the kiln as it ascends, ultimately forming an exhaust stack. This kind of kiln construction qualifies as temporary due to the use of limestone, which decomposes during the firing process. The kiln construction seems to have been designed or engineered according to the composition of the clay body, the number of items, and the type of object being fired, among other considerations. This suggests that ancient firing environments also may have varied to accommodate the differences in clay-body composition revealed through scientific analysis of ancient vessels.[14] Perhaps kiln construction for the ancient Maya entailed a thoughtful extrapolation of clay-body compounding.

Further considerations likely included the safety of the vessels. Fine polychrome ceramics produced for royal courts ranked as objects of high importance. The ancient Maya would have sought to construct a firing environment that would not collapse during firing. They may have first built their kilns with less-than-desirable materials, then fired them empty to test their integrity. Just as they experimented in developing clay bodies, they may have applied a similar methodology to kiln construction in advance of a loaded firing to confirm that the kiln would pass through the process intact. Generational experience likely taught them how to build kilns that had a high probability of surviving a firing, but the use of limestone, which can explode at high temperatures, must have posed a significant challenge.

Typically, beehive kilns include a firebox below the chamber that houses the wares, separating the vessels from the flames and by-products of firing. Kilns used by the present-day Maya lack a lower chamber; they stack the stones from the ground up. Arnold notes the use of saggers by modern Maya potters, who place raw wares inside these ceramic containers to protect them during firing. A temporary firing environment that uses organic fuel such as wood generates flying ash, smoke, and licks of flames. Upon contact with ceramic surfaces, these hazards of the firing process can create discoloration known as fire clouds, as well as other visual and physical damage. Thus, the absence of such markings on most ancient Maya vessels strongly suggests the use of saggers.

The approach to firing artwork by the Maya potter, in some ways, may constitute a cross between Martinez's use of a one-time bonfire and the contemporary studio potter's use of a periodic kiln. Martinez fired her pots in uniform groups of black or red vessels; no batch is mixed. The modern studio potter makes a variety of individual works of diverse shapes, sizes, colors, and surface designs, firing all of them in one periodic kiln. The work of Ronald L. Bishop and Dorie Reents-Budet may support

14 For more on the chemical compositions of clay bodies, see Dorie Reents-Budet and Ronald L. Bishop, "Pottery of the Central and Eastern Peten: A Study of Chemistry and Style," in this volume.

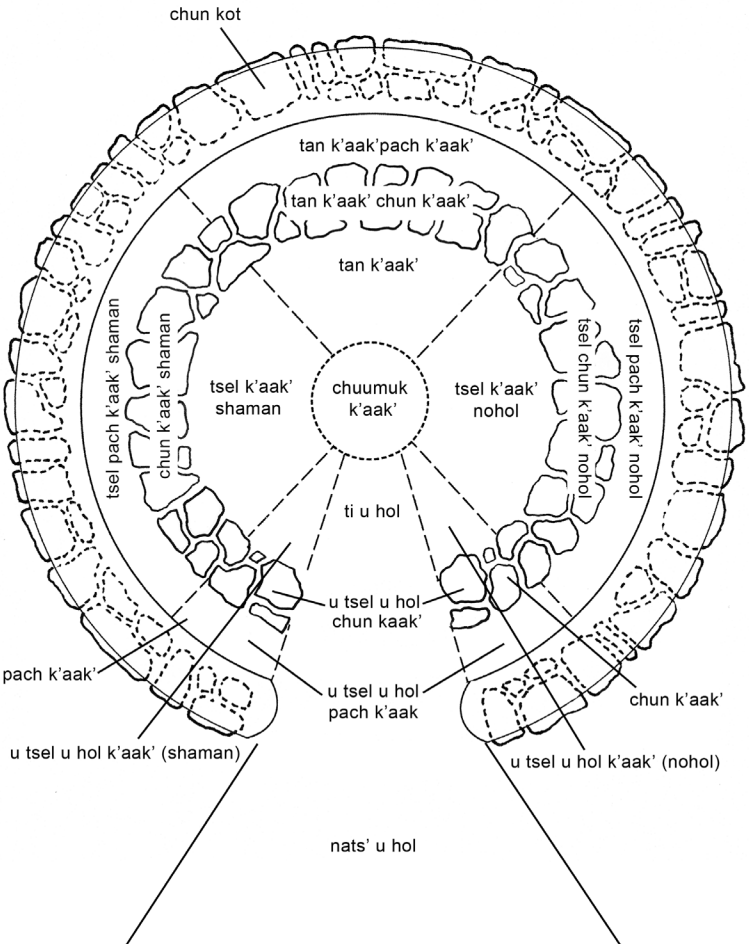


Fig. 3
Diagram of a round temporary kiln (drawing by Michelle Arnold Paine in *Maya Potters' Indigenous Knowledge: Cognition, Engagement, and Practice*, University Press of Colorado, 2018, by Dean E. Arnold)

arguments for a similar practice among ancient Maya potters. Using the chemical signatures obtained through instrumental neutron activation analysis of samples from Maya vessels, they distinguished object groupings based on the chemical similarity of clay-body compositions. These groups, which help to determine the origin of vessels, include objects of varying aesthetics.[15] By extension, if a diversity of vessels were made in the same locale, they may well have been fired together in adaptable temporary firing environments.

15
See Reents-Budet and Bishop, "Pottery of the Central and Eastern Peten," in this volume.

Just as the academic studio potters of the twentieth century in Southern California visited one another's studios to learn from their fellow artists, one can imagine that Maya ceramic culture allowed for a vibrant exchange of firing practices. Comparing notes of who attained what temperature or how one kiln survived while another fell apart may have led to the development of a large body of traditional Indigenous knowledge that researchers have only begun to tap. That body of knowledge, coupled with scientific analysis, can inflect current understandings not only of firing strategies but also of the preparation and use of clays in the manufacturing of vessels and ceramic paints. By acknowledging the value of these resources regarding traditions that have evolved from ancient ceramic practices, scholars can shed new light on methods that, to date, have evaded the archaeological record.

8 Pottery of the Central and Eastern Peten: A Study of Chemistry and Style

Dorie Reents-Budet and Ronald L. Bishop

The Classic Maya repertoire of polychrome pottery is vast and varied. Its diversity not only reflects temporal changes, as functions and aesthetics shifted coincident with social variabilities and personal taste, but also manifests specific sociopolitical elements of the Classic period's (250–900 CE) cultural fabric. From an archaeological perspective, pottery serves as a ready indicator of time and, to a certain extent, social interaction.[1] Pictorial polychrome vessels add details of mythology, religion, and Classic-period history not found elsewhere in the archaeological or ethnohistorical records.[2] As objects of prestige, their religious and ritual narratives played integral roles in the ideology underlying Classic Maya sociopolitical hierarchy.[3] In the context of courtly life, these painted wares served as coveted items, used and exchanged among the ruling elite as part of the processes of relationship building and alliance maintenance needed to successfully navigate the highly competitive environment of the Classic period.[4]

As exchange items, the painted vessels traveled, often moving far from their place of manufacture and the patron who sponsored their creation.[5] When found archaeologically, the investigative challenge lies in determining if the artifact, whether a whole vessel or fragment (sherd), originated locally or arrived from afar. And if imported, where was its place of origin? Whole vessels serve as templates for discerning archaeological ceramic types and artistic styles, both of which aggregate works based on shared visual characteristics, including shape, paste appearance, surface manipulation (molding, modeling, incising, and painting), epigraphic components, and such graphic elements as the use of pictorial space, line quality, and slip-color choices. Yet the majority of whole vessels want for archaeological provenience because they were removed from their final context under uncontrolled circumstances. Therefore, illicit removal has rendered provisional the attribution of pottery styles to specific areas and sites, and the attribution of archaeological types has necessarily been based primarily on the rule of abundance. Investigations of Classic Maya ceramics have lacked corroborative analytical methods to objectively evaluate the production cohesiveness and geographic attribution of a group of similar pottery specimens—whether they represent an archaeological type or variety or a stylistically defined category.

With the advent of scientific analyses developed during the second half of the twentieth century, various methods have been applied to the study of Maya pottery, one of the first being neutron activation analysis (NAA).[6] Initiated in the 1950s at Brookhaven National Laboratory (BNL) in Upton, New York, this analytical technique enabled the differentiation of fine paste groups to distinct production locales in the western Maya lowlands.[7] Additionally, NAA was able to distinguish the variously textured pastes of pottery made at specific locales in and around the major center of Palenque, Mexico.[8] With these attainments, the analytical technique became the core research of the Maya Ceramics Project, undertaken at BNL and supported through donations to the Museum of Fine Arts, Boston. The project moved to the Smithsonian Center for Materials Research and Education in 1983 and now resides in the Department of Anthropology, National Museum of Natural History, at the Smithsonian Institution in Washington, D.C.

The Maya Ceramics Project focuses on detecting patterns of production and exchange of pottery, including the attribution of specific artistic styles to sites and perhaps even to distinct workshops and their artists and patrons. The resulting data provide useful tools for addressing issues of Classic-period ceramic production from spatial, temporal, and sociopolitical perspectives. Thanks to the generous cooperation of national and international institutions and colleagues, the database comprises

1 James C. Gifford, *Prehistoric Pottery Analysis and the Ceramics of Barton Ramie in the Belize Valley* (Cambridge, MA: Peabody Museum of Archaeology and Ethnology, Harvard University, 1976); Robert E. Smith and Gifford, *Maya Ceramic Varieties, Types, and Wares at Uaxactun: Supplement to Ceramic Sequence at Uaxactun, Guatemala* (New Orleans: Middle American Research Institute, Tulane University, 1966).

2 Michael D. Coe, *The Maya Scribe and His World* (New York: Grolier Club, 1973).

3 Mary Ellen Miller and Simon Martin, "The Divine Models of Courtly Culture," in *Courtly Art of the Ancient Maya*, exh. cat. (San Francisco: Fine Arts Museums of San Francisco; New York: Thames & Hudson, 2004), 50–91.

4 Elizabeth M. Brumfiel, "Elite and Utilitarian Crafts in the Aztec State," in *Specialization, Exchange, and Complex Societies*, eds. Brumfiel and Timothy K. Earle (Cambridge: Cambridge University Press, 1987), 102–18; Diane Z. Chase and Arlen E. Chase, "The Architectural Context of Caches, Burials, and Other Ritual Activities for the Classic Period Maya (as Reflected at Caracol, Belize)," in *Function and Meaning in Classic Maya Architecture: A Symposium at Dumbarton Oaks, 7th and 8th October 1994*, ed. Stephen Houston (Washington, D.C.: Dumbarton Oaks Research Library and Collection, 1998), 299–332; Martin and Nikolai Grube, "Maya Superstates," *Archaeology* 48, no. 6 (November/December 1995): 41–46; Dorie Reents-Budet, "Elite Maya Pottery and Artisans as Social Indicators," in "Craft and Social Identity," eds. Cathy Lynne Costin and Rita P. Wright, special issue, *Archaeological Papers of the American Anthropological Association* 8, no. 1 (January 1998): 71–89; Reents-Budet, "Feasting among the Classic Maya: Evidence from Pictorial Ceramics," in *The Maya Vase*

more than 50,000 NAA analyses of pottery from more than 300 archaeological sites in the Maya region and elsewhere in Mesoamerica. Crucially, more than 2,300 of these analyses pertain to unprovenienced whole vessels from museum and institutional collections.

The first step in utilizing the database requires asking a question of association of a vessel, a group of visually similar ones, or an assemblage of archaeologically retrieved specimens. Next, assessment of the specimens considers archaeological type-variety and stylistic viewpoints—the definition and use of style based on George Kubler's analytical approach.[9] His six criteria of visual style determine the groupings of visually related vessels.[10] The integrity of the group as an assemblage of socially and perhaps temporally related objects is then assessed by the objective chemical data obtained through NAA.

Neutron activation analysis determines the concentration of several elements in the clay-and-temper paste used to make a ceramic vessel. The extremely sensitive technique can detect many elements at low (parts per million and below) concentration and offers high analytical precision (reproducibility). These capabilities prove essential when attempting to differentiate among locales of ceramic manufacture that may lie in close geographic proximity and whose clay deposits likely exhibit chemical similarities. Further, an NAA-derived chemical composition reflects potting behavior as much as geographic location, because the sample incorporates the idiosyncratic blend of clay and temper by a potter, workshop, or group of related workshops sharing source materials and paste recipes.

The following discussions examine vessels in the LACMA collection as part of its mission to investigate Classic Maya pictorial ceramics from a multi-disciplinary approach, integrating methods of art history and materials science. The multi-disciplinary study of unprovenienced artifacts yields unique data valuable to the study of Maya archaeological ceramics, history, and social process, serving a broad range of scholars and members of the interested public.

Format and signage constitute two of Kubler's elements of style. For Maya pottery, format refers to vessel shape, size, and overall composition of the imagery. Signage addresses the imagery, including both its iconography (pictures and hieroglyphs) and iconology (the historical interpretive study of images and their contextual significance).[11] Focusing on format and signage, three Early Classic (250–600 CE) lidded tripod

Book: A Corpus of Rollout Photographs of Maya Vases, vol. 6, ed. Justin Kerr (New York: Kerr Associates, 2000), 1022–38.

5
Reents-Budet, *Painting the Maya Universe: Royal Ceramics of the Classic Period*, exh. cat. (Durham, NC: Duke University Press in association with Duke University Museum of Art, 1994).

6
Edward V. Sayre, Alexander Murrenhoff, and Charles F. Weick, *The Nondestructive Analysis of Ancient Potsherds through Neutron Activation* (Upton, NY: Brookhaven National Laboratory, 1958); Russel K. Skowronek, M. James Blackman, and Ronald L. Bishop, *Ceramic Production in Early Hispanic California: Craft, Economy, and Trade on the Frontier of New Spain* (Gainesville, FL: University Press of Florida, 2014), 141–47.

7
Bishop, "Instrumental Neutron Activation Analysis of Archaeological Ceramics: Progress and Challenges," in *Nuclear Analytical Techniques in Archaeological Investigations* (Vienna: International Atomic Energy Agency, 2003), 35–44; Bishop, Robert L. Rands, and George R. Holley, "Ceramic Compositional Analysis in Archaeological Perspective," in *Advances in Archaeological Method and Theory*, vol. 5, ed. Michael B. Schiffer (New York: Academic Press, 1982), 275–331; Edward V. Sayre, Lui-Heung Chan, and Jeremy A. Sabloff, "High-Resolution Gamma Ray Spectroscopic Analyses of Fine Orange Pottery," in *Science and Archaeology*, ed. Robert H. Brill (Cambridge, MA: MIT Press, 1971), 65–81; Sayre, Richard W. Dodson, and Dorothy Burr Thompson, "Neutron Activation Study of Mediterranean Potsherds," *American Journal of Archaeology* 61, no. 1 (January 1957): 35–41.

8
Bishop, "Western Lowland Maya Ceramic Trade: An Application of Nuclear Chemical and Geological Data Analysis," PhD diss. (Southern Illinois University, 1975); Robert L. Rands and Bishop, "Resource Procurement Zones and Patterns of Ceramic Exchange in the Palenque Region, Mexico," in *Models and Methods in Regional Exchange*, ed. Robert E. Fry (Washington, D.C.: Society for American Archaeology, 1980), 19–46; Rands, Bishop, and Garman Harbottle, "Thematic and Compositional Variation in Palenque-Region Incensarios," in *Tercera Mesa Redonda de Palenque*, eds. Merle Greene Robertson and Donnan Call Jeffers (Monterey, CA: Pre-Columbian Art Research Center, Herald Printers, 1979), 19–30.

9
George Kubler, *The Shape of Time: Remarks on the History of Things* (New Haven, CT: Yale University Press, 1962); Kubler, "Toward a Reductive Theory of Visual Style," in *The Concept of Style*, eds. Leonard B. Meyer and Berel Lang (Philadelphia: University of Pennsylvania Press, 1979), 119–27.

10
Kubler, "Toward a Reductive Theory of Visual Style," 1979.

11
See Erwin Panofsky, *Studies in Iconology: Humanistic Themes in the Art of the Renaissance* (New York: Oxford University Press, 1939) and E. H. Gombrich, *Reflections on the History of Art: Views and Reviews*, ed. Richard Woodfield (Oxford: Phaidon, 1987).

vessels in the LACMA collection share a number of stylistic features that support the prospect of their production in a single workshop (fig. 1a–c; cats. 12–14). All three exhibit characteristics of the Balanza Black ceramic group. Based on the reading of the dedicatory phrase on cat. 12 (MS2021), initial analysis located the workshop in Naranjo, a large site in eastern Guatemala. One of the phrase's glyphs features the *sa'* sign, the main component of Naranjo's emblem glyph (fig. 1a). This text seemed to follow the glyphic pattern noted on another vessel, K4681 (in the numbering assigned by Justin Kerr),[12] in which the *kakaw* glyph is preceded by the Ixtutz emblem glyph, thereby designating an Ixtutz association of the beverage (or its base ingredient).[13] However, the current reading of the text considers the *sa'* glyph not as describing geography but instead as specifying the draught, *sa'al kakaw* (gruel-like chocolate).[14]

Paste composition can address the vessel-to-vessel relationship and possible place of manufacture. The paste-compositional profiles support the stylistic assessment that the three tripods' manufacture occurred closely together in space and time. Two (cat. 12 [MS2021] and cat. 13 [MS2023]; fig. 1a, c) show such similar concentrations of the well-determined elements that they likely were made during a single production event (table 1). Cat. 14 (MS2022, fig. 1b) displays slightly lower rare-earth ratios, although its composition falls well within the range of minor variations typical of tempered earthenware made from the same clay resources and paste recipe.

The compositional data do not confirm Naranjo as the workshop's location but instead are statistically attributable to pottery manufacture at Tikal, in northern Guatemala's Peten basin. Analysis of more than five hundred pottery samples from Tikal and its immediate surrounds yields two carbonate-tempered groups that are sufficiently large to permit statistical evaluation based on Mahalanobis distances that incorporate patterns of inter-elemental correlation as well as elemental abundance.[15] Group A contains these three tripod vessels as well as other Early Classic samples excavated at Tikal, the majority belonging to the Balanza ceramic group (Balanza Black, Urita Gouged-Incised, Lucha Incised, and Paradero Fluted). Groups B and C also comprise primarily Early Classic examples but mostly represent other pottery groups and types (fig. 2). Discriminant axes, calculated to show maximum separation among the groups, function here as a graphical means to represent the groups' compositional differences. Solid line confidence ellipsoids, indicating the 90% confidence intervals of groups A and B, are shown in the figure. The dashed 90% confidence ellipse encloses a more heterogeneous "group" C, which describes too few examples to undergo rigorous statistical evaluation.

The minor lower rare-earth ratios of cat. 14 (MS2022; fig. 1b) warrant attention. Although vessel shape and the stucco painting recall those of cat. 12 (MS2021) and cat. 13 (MS2023), a number of stylistic elements distinguishes it cat. 14, including some in its longer hieroglyphic text naming its owner as a vassal of the enigmatic overlord Jatz'oom Kuy or "Spearthrower Owl."[16] Second, large red-orange hieroglyphic cartouches dominate the pictorial space, in contrast to the small and black-outlined ones on cats. 12–13. Third, the modeling details of cat. 14's effigy knob are not present on those of the other vases, although all three knobs likely derived from the same mold. The stylistic and chemical data point to the use of a slightly different paste formulation in cat. 14's manufacture, albeit likely by a potter (or potters) sharing the same resources and recipe, which implies residence in the same or very closely aligned workshops. Whether cat. 14 is the work of a

12 Justin Kerr, *The Maya Vase Book: A Corpus of Rollout Photographs of Maya Vases*, 6 vols. (New York: Kerr Associates, 1989–2000).

13 David Stuart, Barbara MacLeod, Yuriy Polyukhovich, Houston, Martin, and Reents-Budet, "Glyphs on Pots: Decoding Classic Maya Ceramics," in *Sourcebook for the 29th Maya Meetings at Texas, the University of Texas at Austin*, ed. Stuart (Austin: University of Texas at Austin, 2005), 110–97.

14 Alexandre Tokovinine and Vilma Fialko, "Stela 45 of Naranjo and the Early Classic Lords of Sa'aal," *The PARI Journal* 7, no. 4 (Spring 2007): 1–14.

15 Bishop and Hector Neff, "Compositional Data Analysis in Archaeology," in *Archaeological Chemistry IV*, ed. Richard O. Allen (Washington, D.C.: American Chemical Society, 1976) 57–86; Sayre, *Brookhaven Procedures for Statistical Analyses of Multivariate Archaeometric Data* (Upton, NY: Brookhaven National Laboratory, 1976).

ID	MS2021	MS2023	MS2022	CV
Na%	0.49	0.39	0.45	2.2
K%	0.09	0.16	nd	5.3
Ca%	24	25.9	27	nd
Sc	7.31	7.31	6.21	1.7
Cr	45.8	45.9	37.9	3.1
Fe%	2.03	1.97	1.75	3
Co*	5.13	5.6	4.22	2
Zn	44.9	38.6	26.5	10.6
As	4.69	5.11	5.65	5.4
Rb	nd	nd	20	7.7
Zr	233	191	114	nd
Sb	0.82	0.94	0.81	16.8
Cs	0	0.35	0.32	3.1
Ba	313	233	400	12.2
La	7.35	7.43	6.61	1.6
Ce	33.2	34.9	18.5	2.4
Sm	1.17	1.16	0.9	2.5
Eu	0.23	0.23	0.19	3
Yb	1.37	1.24	0.86	5.3
Lu	0.21	0.22	0.13	6.9
Hf	7.55	6.95	4.99	4
Ta*	0.63	0.63	0.53	7.2
Th	9.62	9.62	8.09	2.7
U	1.5	1.9	1.4	15.3

Table 1.
Elemental concentrations of the three Early Classic tripod vessels: cat. 12 (MS2021), cat. 13 (MS2023), and cat. 14 (MS2022)

Concentrations are reported in ppm except for those indicated as %. General analytical precision is provided by the Coefficient of variation (CV), which is calculated by 311 replicate analyses of NBS Standard Reference Material SRM679 Brick Clay, over a seventeen-year period, from 1982 to 1999.

* = value possibly impacted by drill bit contamination; not used in group evaluation

nd = not determined

Fig. 1a.
Cat. 12, MS2021 (M.2012.115.1066a-b, K7529)

Fig. 1b.
Cat. 14, MS2022 (M.2010.115.1067a-b, K7528)

Fig. 1c.
Cat. 13, MS2023 (M.2010.115.1068a-b, K7530)

Fig. 1
A trio of Early Classic tripod vessels made in the same workshop. The nearly equivalent composition of cat. 12 (a.) and cat. 13 (c.) implies that they were formed from the same paste mixture.

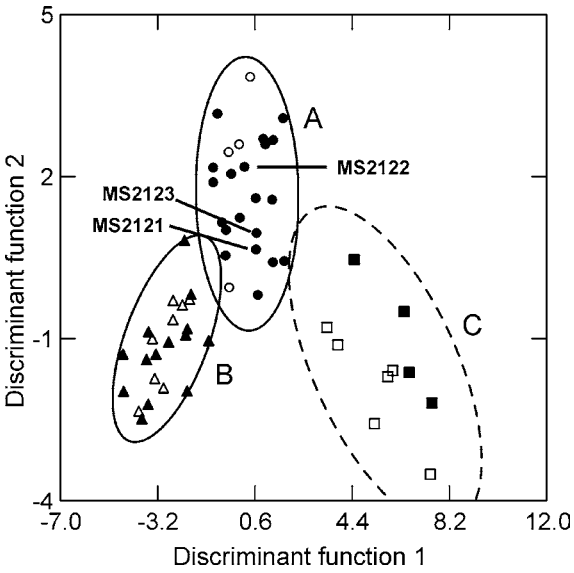


Fig. 2
Groups of Tikal carbonate-tempered ceramics featuring members of the Balanza ceramic group (shown in closed [black] symbols; open symbols indicate non-Balanza carbonate-tempered pottery). Ninety-percent confidence intervals enclose groups A and B. Group C is more heterogeneous and was not statistically evaluated. Discriminant function 1 is most heavily weighted on the contributions of iron (Fe), antimony (Sb), and rare-earth elements. Discriminant function 2 is weighted according to concentrations of scandium (Sc), chromium (Cr), and thorium (Th).

different artist than that of the other tripods cannot be confirmed. At the least, the combined data suggest the painter of cat. 14 accentuated this vase within the group, and it likely comprises a single commission brought to completion at Tikal.

Eastern Peten Pottery Styles and the Baax Witz (Xultun) Polity

With respect to format, a trio of Late Classic (600–800 CE) cylinder vessels (cat. 25 [MS1806], cat. 23 [MS1808], and K8728; figs. 3a–c) displays the same division of pictorial space, beginning with a prominent rim band delimited by black or red lines and containing a standard version of the dedicatory phrase.[17] Thin curvilinear lines define the hieroglyphs in black or red slip paint. Emblazoned on each vessel, a large icon extends from below the rim band to the base, the emblems oriented diagonally and appearing twice on each vase. The icons encompass a profile saurian (serpent) head with varying elements pertaining to the Maya royal *hunal* insignia.[18] As personifications of the *hunal* regal jewel, the variations include a sprouting maize seed, the head of the deity K'awiil, and a Water-Lily Serpent that may signify bodies of water.[19] Although the three tall, parallel-sided cylinders of relatively narrow width share formal similarities, subtle differences in shape, decorative details, glyphic signs, and paint characteristics and application distinguish each one. These variations coincide with paste-compositional patterns identifying diverse clay and temper mixtures, which elsewhere have indicated different clay resources, paste recipes, and locales of manufacture.

The dense red and black slip paints of vessel cat. 25 (MS1806/K7055; fig. 3a) recall features of other vessels attributed to workshops in the Baax Witz (Xultun) area.[20] Its patron appears to be the noblewoman Ix Ch'een(?), one of three royal women named on Baax Witz–associated pottery. Chemically, it matches no

16
Simon Martin and Nikolai Grube, *Chronicle of the Maya Kings and Queens: Deciphering the Dynasties of the Ancient Maya*, 2nd ed. (London: Thames & Hudson, 2008), 30–31.

17
Coe, *Maya Scribe*; Houston, David Stuart, and Karl A. Taube, "Folk Classification of Classic Maya Pottery," *American Anthropologist* 91, no. 3 (September 1989): 720–26; Barbara MacLeod and Reents-Budet, "The Art of Calligraphy: Image and Meaning," in Reents-Budet et al., *Painting the Maya Universe*, 106–63; Stuart, "The Río Azul Cacao Pot: Epigraphic Observations on the Function of a Maya Ceramic Vessel," *Antiquity* 62, no. 234 (March 1988): 153–57.

18
David A. Freidel and Linda Schele, "Kingship in the Late Preclasssic Lowlands: The Instruments and Places of Ritual Power," *American Anthropologist* 90, no. 3 (September 1988): 547–67.

19
Houston, "Living Waters and Wondrous Beasts," in *Fiery Pool: The Maya and the Mythic Sea*, eds. Daniel Finamore and Houston, exh. cat. (Salem, MA: Peabody Essex Museum, in association with Yale University Press, 2010), 72–73; Guido Krempel and Sebastian Matteo, "La nobleza y el estilo cerámico de Yootz, Petén, Guatemala" in *XXIII Simposio de Investigaciones Arqueológicas en Guatemala, 2009*, eds. Bárbara Arroyo, Adriana Linares Palma, and Lorena Paiz Aragón (Guatemala City: Museo Nacional de Arqueología y Etnología, 2010), 1202–16.

20
Krempel and Matteo, "Painting Styles of the North-Eastern Peten from a Local Perspective: The Palace Schools of Yax We'en Chan K'inich, Lord of Xultun," in "Proceedings of the 1st Cracow Maya Conference: Archaeology and Epigraphy of the Eastern Central Maya Lowlands," eds. Christophe Helmke and Jarosław Źrałka, special issue, *Contributions in New World Archaeology* 3 (2012): 154.

other samples in the compositional database, which unfortunately lacks excavated specimens from Baax Witz. Regarding elements of format, signage, and modus (the chosen manner to express a particular content), cat. 25's shape and glyphic contents resemble those of the red-on-cream vase, cat. 23 (MS1808/K7459; fig. 3b), and K8728 (fig. 3c). The latter vessel names its patron/owner as Taxin Chan Ajaw, a nobleman of the royal house of Yootz, which had close affiliations with Baax Witz rulers during the second half of the eighth century.[21] Given their shared paint characteristics, format, and signage despite their naming different nobles, the same artist may have painted both vases (cat. 25 and K8728). Minor differences in the form and quality of the glyphs suggest the work of two different artists, although those on cat. 25 have been repainted in modern times.

Erik Boot has discussed occurrences of the Yootz emblem glyph and the names of its early eighth-century nobles on painted pottery vessels, including those of Taxin Chan Ajaw, the ruler Yajawte' K'inich, and his successor, K'ahk' Yohl K'inich (c. 700–750 CE). Boot associates all with texts on monuments and ceramics from Baax Witz and locales in the immediate vicinity, including the elusive Yootz site.[22] The plate K4669 (MS1421; fig. 3j) affirms this eighth-century association, naming its patron/owner Ahk Nikte' as the servant of K'ahk' Yohl K'inich, ruler of Yootz. Yet the plate's painting style and paste composition match those of K4387 (MS1398; fig. 3i). The data point to production from the same paste and painting by one artist, and thus likely manufacture in the same workshop. Of nearly the same composition, vessels cat. 21 (MS1721/K5976) and MS0948 proclaim owners/patrons of Baax Witz nobility of various ranks. As a group, the four vessels represent high-status pottery made for Yootz and Baax Witz nobility, and their chemical, stylistic, and epigraphic similarities suggest linked production and social relations. The database cannot confirm Baax Witz as the workshop's location, although the evidence tips toward the site's vicinity as the most likely candidate.

The paste composition of the elegantly painted cat. 23 (MS1808/K7459; fig. 3b) initially showed no similarity to any other samples. By restricting the elemental list, a few similarities emerged with works including the Zacatal Cream Polychrome cylinder vase in the LACMA collection (M.2010.115.644 [MS1723/K6100]; fig. 3d) and a number of Cabrito Cream Polychrome (Holmul-style) vessels, among them a plate in the collection of the Museum of Fine Arts, Boston (2004.240 [MS2261]; fig. 3e), and a vase sherd excavated at Xunantunich, Belize (MSBX024). Also chemically comparable is a restricted-orifice bowl sherd from a palace midden at the western Belizean site of Buenavista del Cayo (MSBU10; fig. 3f). Its restricted bowl, or *tecomate*, form occurs throughout the eastern Peten lowlands and spans the Classic period at many sites, including Baax Witz.[23] An unprovenienced bowl, K6882 (fig. 3g), displays the same modus, signage, and format as the sherd from Buenavista del Cayo. Epigraphically, both bowls' glyphs typify some eastern Peten pottery texts.[24]

This typologically broad but chemically and stylistically restricted group shares solid red and black color fields commingled with diluted washes on a cream-white base slip (fig. 3). They all rely on thin, curvilinear contour lines in red or black paint to define the pictorial and glyphic forms. The painters also utilized both thin and wide red bands to subdivide the pictorial fields. The decorative band of step-fret or S motifs segregating the rim text from the image zone constitutes an unusual feature of cat. 23 (MS1808; fig. 3b) and K6100 (MS1723; fig. 3d). Interestingly, the group's paste composition recalls another sherd, MSBX77 (fig. 3f), excavated

21 Krempel and Matteo, "Painting Styles of the North-Eastern Petén," 154–55, 157.

22 Erik Boot, "A New Naranjo Area Toponym: *yo:ts*," *Mexicon* 21, no. 2 (April 1999): 39–42; Boot, "A Short Epigraphic Analysis of the Hieroglyphic Text on a Tripod Plate in a Private Collection (Guatemala)," *Maya Vase Database* (website), August 5, 2005, http://www.mayavase.com/guatplate.pdf. See also Thomas G. Garrison and Stuart, "Un análisis preliminar de las inscripciones que se relacionan con Xultún, Petén, Guatemala," in *XVII Simposio de Investigaciones Arqueológicas en Guatemala, 2003*, eds. Laporte et al. (Guatemala City: Museo Nacional de Arqueología y Etnología, 2004), 829–42, and Krempel and Matteo, "Neuzugang: Ein polychromer Tonteller aus Yootz," *Baessler-Archiv*, n.s., 56 (2008): 244–48.

23 Patricia Rivera Castillo et al., "Estructura 11J7: Recintos ceremoniales; entierros 10 y 12, Xultún," in *Proyecto Arqueológico Regional San Bartolo-Xultún: Informe de resultados de investigaciones temporada de campo no. 11, año 2012*, eds. Rivera Castillo and William Saturno (unpublished manuscript on file, Instituto de Antropología e Historia de Guatemala, Guatemala City, 2012), 217.

24 Krempel and Matteo, "Painting Styles of the North-Eastern Petén," 155–57; Stuart et al., "Glyphs on Pots: Decoding Classic Maya Ceramics," 110–97.

Fig. 3a

Fig. 3b

Fig. 3c

Fig. 3e

Fig. 3f

Fig. 3g

Fig. 3h

Fig. 3i

Fig. 3j

Fig. 3k

Fig. 3
Eastern Peten pottery styles associated with ceramic production in the Baax Witz (Xultun) polity

a. Cat. 25, MS1806 (M.2010.115.790, K7055)
b. Cat. 23, MS1808 (M.2010.115.844, K7459)
c. K8728
d. K6100/MS1723
e. Plate with rattle supports, Late Classic Period, 650–750 CE, Maya (place of origin: Naranjo/Holmul-Xultun area, eastern Peten, Guatemala), earthenware, pink, black, and orange slip decoration, 15 × 15 × 4 7/8 in. (38.1 × 38.1 × 12.4 cm), Museum of Fine Arts, Boston, gift of Lavinia and Landon T. Clay, 2004.240
f. MSBU10
g. K6882
h. MSBX77
i. K4387/MS1398
j. K4669/MS1421
k. Atole drinking vessel for a prince of Xultun, c. 750 CE, Guatemala, Xultun region, Maya, earthenware, 4 3/8 x 5 15/16 x 5 15/16 in. (11.1 x 15.1 x 15.1 cm), Fine Arts Museums of San Francisco, gift of Gail and Alec Merriam, 2012.69.12

from the same Buenavista del Cayo palace context as MSBU10.[25] Its stylistic, iconographic, and epigraphic features recall elite ceramic production in the Naranjo zone, with fragmentary hieroglyphic text recording the now-lost name of a captive of a young lord of Sa'aal, that is, Naranjo.[26] MSBX77's assessment as a Naranjo product remains uncertain because it shares chemical similarities with only one chemically sampled sherd excavated at the site. However, the database's chemical characterization of Naranjo pottery production is far from adequate due to the low number of samples (171), with limited typological breadth and archaeological context. This restricted corpus prevents the statistical formation of groups that would allow confident identification of local products, which hinders the Maya Vase Research Project's ability to address questions concerning Naranjo ceramic production with certainty. Consequently, conclusions must often derive from negative evidence rather than positive correlations.

In spite of this deficiency, the compositional profile of MSBX77 may be reassessed using refined statistical analyses of the well-determined subset of elements and in light of hundreds of recent samples from eastern Peten sites. The reevaluation places MSBX77 within the chemical parameters of the Baax Witz–associated vessels illustrated in figure 3, most notably K4387 (MS1398) and K4669 (MS1421). These two vessels belonged to a lord of Baax Witz and of Yootz, respectively, yet they were painted by the same artist and have near chemical similarity in trace elements at the level of parts per million. That is to say, the data affirm their formation from the same paste preparation, likely at the same time, as well as having been painted by the same person. Stylistic features emphasize their close relationship to MSBX77, and although the project has yet to analyze a paste sample, the same painter may also have decorated K1547 (fig. 3k).

As the product of a Baax Witz–area workshop, two points arise concerning MSBX77's artistic and sociopolitical implications. One concerns its "fleur-de-lis" icon, which occurs on at least one vase from Naranjo as well as on others found or made at sites in the eastern Peten and western Belize River Valley (e.g., K635 [MS1375]).[27] This icon, as well as a similar flower-like motif,[28] often decorates vessels of the archaeological type Chinos Black-on-Cream, especially those whose texts name Baax Witz and Yootz persons and whose paste chemistry points to production in the sites' general area. As discussed by Guido Krempel and Sebastian Matteo, the "fleur-de-lis" and four-petal icons may simply constitute an artistic mélange shared throughout the greater eastern Peten.[29] Both are less prevalent at Naranjo in spite of a famous large cylinder vase chemically attributable to Naranjo pottery production and naming Naranjo royalty.[30] A strong association of Chinos Black-on-Cream pottery with Naranjo production remains uncertain, in part, because the site's ceramic analysis has not been published. It may not have constituted a common type at Naranjo, and the database currently contains only two Chinos sherds among the 171 Naranjo samples. The present study cannot properly assess the Chinos Black-on-Cream/Naranjo question, although the limited data does not indicate a strong association with the "fleur-de-lis" icon. Instead, the data point to a clearer correlation with eastern Peten ceramic traditions in the Baax Witz-Yootz area.

The second point concerns the sociopolitical implication of MSBX77 as a product of a Baax Witz-Yootz workshop, yet seemingly made for a Sa'aal (Naranjo) nobleman and excavated from palace contexts at Buenavista del Cayo. This production and exchange record constitutes a direct indicator of relations among the Baax Witz, Naranjo, and Buenavista nobility. It also confirms the act of re-gifting elite pottery among the Late Classic aristocracy.

25 Reents-Budet et al., "Out of the Palace Dumps: Ceramic Production and Use at Buenavista del Cayo," *Ancient Mesoamerica* 11, no. 1 (Spring 2000): 103–4.

26 Houston, Stuart, and Taube, "Image and Text on the 'Jauncy' Vase," in *The Maya Vase Book: A Corpus of Rollout Photographs of Maya Vases*, vol. 3, ed. Justin Kerr (New York: Kerr Associates, 1992), 499–512; Reents-Budet et al., *Painting the Maya Universe*, 55; Tokovinine and Fialko, "Stela 45 of Naranjo," 1.

27 Reents-Budet et al., *Painting the Maya Universe*, 61–66.

28 See Reents-Budet et al., "Out of the Palace Dumps," fig. 2.

29 Krempel and Matteo, "La nobleza y el estilo cerámico," 1206–08.

30 Houston, Stuart, and Taube, "Folk Classification"; Reents-Budet et al., *Painting the Maya Universe*, 319.

Scrutiny of all vessels in the project's database with the "fleur-de-lis" icon identified another example that may have had a similar history, MS1874, a tall Zacatal Cream-Polychrome vase. It features two diagonal black bands embellished with "fleur-de-lis" emblems, and its hieroglyphic text names a Baax Witz nobleman. Although the format and signage vaguely recall a few Naranjo vessels, including K635 (MS1375), the style and contents of the hieroglyphic text pertain to Baax Witz–area aristocrats and pottery styles. Yet its paste chemistry resembles samples excavated at the northeastern Peten site of Nakum, Naranjo, and Tikal, as well as a vessel at the Museum of Fine Arts, Boston (1988.1255 [MS1085]), whose painting style resembles pottery chemically attributed to these three sites. Although MS1874 lacks archaeological provenience, style and chemistry distinguish it as a product of the Tikal-Nakum-Naranjo area made for a lord of Baax Witz.

Cat. 22 (MS1813; fig. 4a) displays the same Baax Witz–associated stylistic elements of a solid-colored background, main image oriented diagonally and featuring a saurian-headed icon (K'awiil, *hunal*, or a water-lily entity), and a rim band with large, black-outlined glyphs naming a noble person (cf. cat. 25 and K8728 [fig. 3a, c]). However, close inspection of the format and modus discerns subtle divergences suggestive of a different aesthetic configuration. First, the shape is slightly convex. Second, the base slip is more cream-hued than is typical of the Baax Witz-Yootz corpus. Third are the meticulous fine-line details in the hieroglyphs. Fourth is the lack of red and orange color washes common on Baax Witz–area vessels. And last, the main icon may be an idiosyncratic version of the *hunal* emblem, although here it incorporates elements of the water lily, which recalls pottery made in the Tikal-Lake Peten Itza region.

The patron of cat. 22 is a woman of the Tikal (or less likely, Dos Pilas) royal line. The vase's paste chemistry resembles that of tall cylinder vases displaying comparable stylistic features (fig. 4b–d) and Saxche Orange Polychrome vase sherds excavated in Guatemala at Aguateca and Punta de Chimino, in the Petexbatun region (DPAG28, DPAG45, DPC168).[31] An unprovenienced ceramic replica of a shell paint palette in the national collections of Guatemala also displays chemical similarity (Museo Nacional de Arqueología y Etnología, T82-7-1A-21 039 M44; fig. 4e) to cat. 22. The aggregate compositional profile of these five examples points to production in the Lake Peten Itza area but exclusive of the site of

31 Antonia Foias, "Changing Ceramic Production and Exchange Systems and the Classic Maya Collapse in the Petexbatun Region" (PhD diss., Vanderbilt University, 1996).

Fig. 4e
Museo Nacional de Arqueología y Etnología, Guatemala City (T82-7-1A-21 039 M44), MSM308

Fig. 4a–e
Pottery made in the Lake Peten Itza area, exclusive of the site of Motul de San José (the Ik' site), based on paste composition and pottery style

a. Cat. 22, MS1813 (M.2010.115.572, K1941)
b. K717/MS0059
c. K3699/MS1096
d. Cylinder vase, 600–900 CE, Maya, polychrome and pigment, diameter: 6¼ in. (15.9 cm), collection of the Nasher Museum of Art at Duke University, gift of Elizabeth Brown, 1979.56.3 (photograph by Peter Paul Geoffrion)

Fig. 4a

Fig. 4b

Motul de San José (the Ik' site). Some similarity is shown with a few sherds excavated in the Peten at Tayasal and La Naya, a small site near Yaxha on the eastern side of the lakes area. However, such a small number cannot support a firm attribution for production at either site.

Yet as a product of a Lake Peten Itza–area workshop, cat. 22's resemblance to the red-background vase K2295 merits attention. The dedicatory phrase and diagonal hieroglyphic texts assign K2295 to a painter from the Ik' site who produced the vase for a Río Azul nobleman, Aj Pitzil K'inich.[32] Krempel and Matteo describe the Ik' artist's choosing of stylistic features from the related Baax Witz-Río Azul styles to decorate K2295 while retaining elements characteristic of Ik'-style pottery from the Lake Peten Itza area. The paste composition of cat. 22 supports the stylistic and hieroglyphic-based conclusions of Krempel and Matteo.

32 Krempel and Matteo, "Painting Styles of the North-Eastern Petén," 164.

Fig. 4c

Fig. 4d

The Area Group

The region from Lake Peten Itza to western Belize often fell under the influence of the major power center of Naranjo, whose emblem glyph, translated as *Sa'aal*, means "the place where maize gruel abounds."[33] Originally, this seems to have referred to a centrally located hill and architectural complex, whereas the site and its surrounding lands may have been known by the name *maxam*.[34] As the region's largest and predominant center for many centuries, Naranjo played a key role in Classic-period politics. It was aligned first with Tikal during the fourth and fifth centuries, exemplified by Naranjo's first known ruler, Tzik'in Bahlam (c. late fourth century CE), being the maternal grandfather of Tikal's renowned ruler Chak Tok Ich'aak II (c. 460–508 CE). Following Tikal's troubled hiatus period (508–562 CE), Naranjo variably aligned or clashed with the nearby centers of Calakmul, Caracol, Holmul, and Xunantunich until Naranjo's monumental record falls silent around the year 830.

The site has suffered extensive damage from looting activities that began in the 1920s and surged in the 1960s with the smashing and illicit removal of stone monuments. Itinerant digging into mounds over the years, followed by the total control of the site by a large force of looters from 1997 until 2001, resulted in the digging of 270 tunnels and trenches in pursuit of tombs and artifact caches. Untold numbers of artifacts were removed and either discarded or sold on the international art market. After the looters were dislodged from the site, an archaeological project directed by Vilma Fialko in 2002–4 focused on assessing the damage and properly retrieving and scientifically analyzing the remnants.[35] Although excavation reports have been written and condensed versions published, the ceramic analysis remains unavailable.[36] Yet the combined excavation data, epigraphic research, and limited ceramic analytical work have expanded current understanding of the prominent sociopolitical role played by Naranjo.[37]

A group of stylistically similar bowls and cylinders nicknamed the "Area Group" may have come from Naranjo (fig. 5a–d).[38] The site attribution initially derived from the presence of Naranjo Ruler 1's name in the dedicatory phrase on nine Area Group vessels (e.g., cats. 8 and 19).[39] Ruler 1's nominal, previously translated as Aj Wosal Chan K'inich, is now transcribed as AJ-?NUUM-sa-ji CHAN K'INICH, or Aj Numsaaj Chan K'inich[40]—alternatively, Aj Asaaj Chan K'inich.[41]

33 Tokovinine and Fialko, "Stela 45 of Naranjo," 1.

34 Tokovinine and Fialko, "Stela 45 of Naranjo," 13; Stuart, *The Yaxha Emblem Glyph as Yax-ha; A New Child-Father Relationship Glyph*, Research Reports on Ancient Maya Writing 1–2 (Washington, DC: Center for Maya Research, 1985); Stuart, *Ten Phonetic Syllables*, Research Reports on Ancient Maya Writing 14 (Washington, DC: Center for Maya Research, 1987).

35 Fialko, "Archaeological Research and Rescue Project at Naranjo: Emerging Documentation in Naranjo's Palacio de le Realeza, Petén, Guatemala," trans. Eduardo Williams, *FAMSI* (website), 2009, http://www.famsi.org/reports/05005/index.html; Fialko, "The Map of the Southwest Periphery of Naranjo, Petén, Guatemala," trans. Williams, *FAMSI* (website), 2009, http://www.famsi.org/reports/06098/index.html.

36 Unpublished reports are located in the PROSIAPETEN-PRONAT archives, Instituto de Antropología e Historia, Guatemala City: Fialko, Laura Gámez, and Daniel Aquino, "Investigaciones arqueológicas y rescate en Naranjo: Temporada 2003"; Fialko, Gámez, and Aquino, "Investigaciones arqueológicas y rescate en Naranjo: Temporada 2004"; Fialko and Fredy Ramírez, "Informe final de la temporada de campo de Arqueología Regional correspondiente al año 2002"; and Fialko and Ramírez, "Informe final de la temporada de campo de Arqueología Regional correspondiente al año 2004." Condensed published reports appear as follows: Fialko, "Proceso evolutivo del epicentro monumental de Naranjo, Petén," in *XVIII Simposio de Investigaciones Arqueológicas en Guatemala, 2004*, eds. Juan Pedro Laporte, Arroyo, and Héctor E. Mejía (Guatemala City: Museo Nacional de Arqueología y Etnología, 2005), 225–33; Fialko, "El palacio mayor de la realeza de Naranjo, Petén," in *XIX Simposio de Investigaciones Arqueológicas en Guatemala, 2005*, eds. Laporte, Arroyo, and Mejía (Guatemala City: Museo Nacional de Arqueología y Etnología, 2006), 325–32.

37 Fialko, *Investigaciones arqueológicas en Naranjo: Primeras observaciones sobre el desarrollo cultural del centro urbano* (Mainz, Germany: Verlag Philipp von Zabern, 2004); Martin and Grube, *Chronicle of the Maya Kings and Queens*, 69–83; Joel Skidmore, "An Updated Listing of Early Naranjo Rulers," *The PARI Journal* 7, no. 4 (Spring 2007): 22–23.

38 Bishop, Harbottle, Reents-Budet, Sayre, and Lambertus van Zelst, "Compositional Attribution of Non-Provenienced Maya Polychrome Vessels," in *Application of Science in Examination of Works of Art*, eds. Pamela A. England and Van Zelst (Boston: Museum of Fine Arts, 1985), 117–24; Reents-Budet et al., *Painting the Maya Universe*, 201–7.

39 Beyond cats. 8 and 19, other "Area group" vessels with Naranjo Ruler 1's name are Mint Museum 1985.102.5, K2704 (Tikal Bu. 72), K4562, K5042, K5746, K8245, and Nasher Museum of Art 1981.67 (MS0285).

40 Martin and Grube, *Chronicle of the Maya Kings and Queens*, 71–72; Martin et al., "Contexto y texto de la estela 47 de Naranjo-Sa'aal, Petén, Guatemala," in *XXIX Simposio de Investigaciones Arqueológicas en Guatemala, 2015*, eds. Bárbara Arroyo, Luis Alberto Méndez Salinas, and Gloria Ajú Alvarez (Guatemala City: Museo Nacional de Arqueología y Etnología, 2016), 617; Tokovinine, "Of Snake Kings and Cannibals: A Fresh Look at the Naranjo Hieroglyphic Stairway," *The PARI Journal*, vol. 7, no. 4 (Spring 2007): 19.

41 Jeb J. Card and Marc Zender, "A Seventh-Century Inscribed Miniature Flask from Copan Found at Tazumal, El Salvador," *Ancient Mesoamerica* 27, no. 2 (Fall 2016): 288.

Aj Numsaaj acceded to the throne in 546 CE and ruled for sixty-nine years, dying soon after 615.[42] Naranjo enjoyed close ties to Tikal during the fourth and fifth centuries. By 546, however, Naranjo was under the aegis of the Snake (Kaanul) kingdom, whose political expansion included its ruler K'altuun Hix (or Tuun K'ab Hix, c. 520–572 CE) "supervising" Aj Numsaaj's accession.[43] At this time, the Kaanul kingdom was also moving its capital from Dzibanche, in southeastern Mexico, to Calakmul, a process they completed by 590. Tikal continued to dominate its area southward to Lake Peten Itza and challenged Calakmul's political efforts in the eastern Peten. Naranjo gained some level of independence from Calakmul around the time of Aj Numsaaj's death; however, around sixteen years later, in 631, Naranjo fell to Calakmul, which attacked with the assistance of Caracol, located in western Belize. This brief account of politics illustrates the complex and tumultuous sociopolitical environment surrounding the production and use of Area Group pottery during the mid-sixth and early seventh centuries.

Area Group sherds or whole vessels have been excavated at several sites: three at Tikal, four at Naranjo, two at Copan, and one each at Caracol, nearby Barton Ramie, and the Chabil Ukal rockshelter in southern Belize.[44] This distribution reflects sociopolitical relations at the time of Area Group production and use—from Tikal arching through the eastern Peten and southern Belize to northern Honduras. But where was the center of production? The present study addresses this question by combining considerations of artistic style and paste chemistry to investigate intra-group relationships and seek places of production and use. Such research can aid in assessing the Area Group's role in the Classic Maya ceramic domain while augmenting epigraphic and archaeological appraisals of the sociopolitical climate during the reign of Aj Numsaaj.

The Area Group comprises a subset of elite pottery produced during the early decades of the Tepeu 1 ceramic phase (550–700 CE),[45] a corpus encompassing at least twenty-five whole vessels found primarily in museum and private collections. The Area Group style is characterized by a restricted range of vessel shapes, formal approaches to the picture plane, iconographic themes, and hieroglyphic format and nominal contents (personal names and titles). Treated as a single stylistic reference unit, the group's paste composition, too, reflects its distinction within the Classic Maya corpus of painted ceramics. Minor compositional variations indicate differing paste resources and potting behaviors that may reflect production in numerous workshops and modifications over time.

Previous evaluations of the compositional data failed to confirm Naranjo as the location of the workshop (or workshops).[46] The factors underlying this initial failure have been addressed during the ensuing decades, foremost through the growth of the comparative database to include more samples from the eastern Peten (for instance, 171 from Naranjo, 567 from Holmul and its vicinity, more than 1,000 from the western Belize River valley, more than 550 from Caracol, and 635 from southern Belize). Secondly, statistical approaches to assessing compositional similarity in two- and three-dimensional mathematical space have improved, coupled with an increasingly nuanced geo-chemical understanding of the implications of subtle elemental variations in lowland Maya ceramic paste compositions.

Yet, in spite of these advances, the Area Group continues to defy attribution to one or more specific places of manufacture at a sufficient level of certainty. The group and individual vessel compositions consistently indicate similarity to pottery previously associated with ceramic production at or near the site of Holmul. This attribution

42 Martin and Grube, *Chronicle of the Maya Kings and Queens*, 71–72.

43 Ibid., 72.

44 Excavated examples of "Area Group" vessels. Tikal: Marshall J. Becker, *Excavations in Residential Areas of Tikal: Groups with Shrines*, Tikal Report 21 (Philadelphia: University Museum, University of Pennsylvania, 1999), fig. 55; MST078–079 and MST093. Naranjo: NR0028, NR0084, and Fialko, "Archaeological Research and Rescue Project at Naranjo," figs. 27 and 29. Copan: MSC133 and MSC248. Caracol: A. Hamilton Anderson, "More Discoveries at Caracol, British Honduras," *Actas del XXXIII Congreso Internacional de Americanistas, San José, 20–27 Julio 1958* 2 (1959): 211–18. Barton Ramie: MABR40. Chabil Ukal rockshelter in southern Belize: SB0538–539.

45 Gifford, *Prehistoric Pottery Analysis*, 46

46 Bishop et al., "Compositional Attribution of Non-Provenienced Maya Polychrome Vessels."

Fig. 5
Examples of the Area Group pottery style (a–e, h) and compositionally identified members of the core Area Group (f, g) representing ceramic production in the same vicinity and/or workshops

a. Cat. 19, MS1810 (M.2010.115.756, K6813)
b. Melon-shaped bowl, 600–900 CE, Maya, polychrome, 5 x 7 in. (12.7 x 17.8 cm), collection of the Nasher Museum of Art at Duke University, gift of Dr. and Mrs. James Redd, 1981.67.1 (photograph by Peter Paul Geoffrion)
c. Cat. 8, MS2070 (M.2010.115.871, K7716)
d. Bowl, 550–650 CE, Naranjo area, eastern Peten lowlands, Guatemala, Maya, earthenware with slip paint, 4½ x 7½ x 7½ in. (11.4 x 19.1 x 19.1 cm), courtesy of the Fralin Museum of Art at the University of Virginia, gift of Mr. and Mrs. Robert Sher, 1980.60.9
e. NR0028, Acropolis (looter's backdirt), Central Zone, Naranjo, Guatemala
f. Cylinder vessel with abstract feathered serpent and glyphs, c. 550–850 CE, Maya, ceramic with cream, red, orange, black, and green slip paints, 8 x 5½ in. (20.3 x 14 cm), collection of the Nasher Museum of Art at Duke University, gift of Dr. William Domeyer, 1980.8.1 (photograph by Peter Paul Geoffrion)
g. MSBU34, Palace midden (Tecpan/HUT N/Boneyard), Buenavista del Cayo, Belize
h. MST078, Tikal (Operation 12L/31), Guatemala

runs counter to the vessels' epigraphic tie to Naranjo Ruler 1. Ceramic production at Holmul for a Naranjo ruler of the sixth and seventh centuries is not out of the question given the two sites' close ties, although the Classic-period pattern elsewhere draws a close geographic connection between royal patron and workshop location. This study espouses an epigraphic approach to the question of Area Group production locales and examines three NAA-sampled vessels whose texts name Ruler 1, Aj Numsaaj, as their patron: cat. 19 (MS1810); a bowl in the collection of the Nasher Museum of Art at Duke University in Durham, North Carolina (1981.67 [MS0285]); and cat. 8 (MS2070) (fig. 5a–c).

Cat. 19 (fig. 5a) is eliminated from the study due to anomalously low elemental concentration values suggestive of the sampling of a restored area. The Nasher bowl (MS0285; fig. 5b) epitomizes the Area Group style. In addition to format and modus characteristics, the signage features the Naranjo-associated feline-hummingbird supernatural patron.[47] Its vessel shape and rim text bear striking similarities to another unprovenienced bowl (MS1202; fig. 5d) as well as a bowl sherd excavated at Naranjo (NR0028; fig. 5e). Both samples are chemically related to a relatively large number of Naranjo-excavated examples and, therefore, may be Naranjo products. In contrast, the Nasher bowl clusters with the chemically defined core Area Group, which more closely resembles Holmul-excavated samples, albeit with weak compositional patterning (fig. 5f, g).[48]

Cat. 8 (MS2070; fig. 5c) represents a third subset. Its glyphic text also names Aj Numsaaj, but its scene recounts a historical event unlike the mythological imagery typical of the Area Group style. Here, a ruler (likely Aj Numsaaj) sits in front of a palanquin-like sculpture depicting the jaguar-hummingbird deity emblematic of Late Classic Naranjo. This supernatural, rendered in zoomorphic or anthropomorphic form, features on Area Group vessels in depictions stressing the jaguar or hummingbird/wing traits.

The narrative idiosyncrasy of cat. 8 matches that of its paste composition, which suggests either a completely different ceramic system or a chemically singular paste recipe. The former seems unlikely given its stylistic conventions and non-carbonate paste, which accords with that of the Area Group. The closest chemical matches, however, relate it to pottery from sites in the Tikal periphery, Nakum, Motul de San José, and nearby settlements. Within the limits of the Naranjo samples, cat. 8 shows no compositional pattern indicating production at the site. Although an unassailable conclusion cannot be drawn, the data points to a different set of circumstances driving the creation of this vessel. The hieroglyphic text lists youthful titles for Aj Numsaaj, and the scene illustrates the kind of battle victory rite typical of a monarch's early life accomplishments. These attributes suggest the vase dates to the king's initial years and represents a Naranjo-area workshop using clay resources and/or a recipe different from later vessels.

In sum, the three bowls described above—the Nasher bowl (MS0285), the unprovenienced bowl (MS1202), and the bowl sherd excavated at Naranjo (NR0028)—differ chemically from cat. 8 and the core Area Group. At this time, the database cannot confirm Naranjo as their place of manufacture, although it does rule out Tikal and sites in western Belize as probable locations, and Holmul presents as a weak contender. The group's ceramic types, artistic style, and compositional patterns conform with Late Classic pottery production in the eastern Peten region, which encompasses Naranjo, Holmul, and myriad satellite centers. Overall, the combined data sets suggest the Area Group represents specialized production in one or more

47 Martin, "Tikal's 'Star War' Against Naranjo," in *Eighth Palenque Round Table, 1993*, eds. Martha J. Macri and Jan McHargue (San Francisco: Pre-Columbian Art Research Institute, 1996), 223–36.

48 Other samples that comprise this chemically defined core Area Group include BP16, SBV005, and MST078.

workshops located in the geopolitical sphere of Naranjo. The compositional differences may reflect potting behaviors in different but related workshops and/or recipe changes during the long reign of Aj Numsaaj.

This brief study of Classic Maya pottery vessels in the LACMA collection combines art history, epigraphy, and paste chemistry to identify styles of painted ceramics and search for their places of manufacture. Discerning such patterns of production and exchange may shed light on sociopolitical characteristics of the Classic period and the roles played by these specialized ceramic objects in the ancient Maya world.

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9 Maya Painted Vessels in Context: An Overview of Maya Culture

Héctor Leonel Escobedo Ayala

The central Maya lowlands encompass the nuclear zone from which Classic Maya culture developed. The territory includes most of the department of Peten in Guatemala, all of Belize, and part of the Mexican states of Chiapas and Tabasco, extending into the states of Campeche, Yucatan, and Quintana Roo to the north. Within this region, archaeologists have discovered abundant evidence that demonstrates the significant artistic and intellectual achievements of the ancient Maya, as well as numerous urban centers whose buildings have survived the passage of centuries.

The high degree of cultural development achieved in the central Maya lowlands is even more surprising because inhabitants had access only to a Neolithic technology. The ancient Maya mined flint deposits to produce lithic artifacts needed to cut, puncture, and scrape. In fact, metals were not introduced into the area until after 900 CE, during the Postclassic period (900–1539 CE), and locals used them only for fine jewelry.[1] In addition, they did not have beasts of burden, nor use the wheel to transport the huge, heavy stones that compose their monumental buildings.

Maya social organization was pyramidal: The elite enjoyed greater wealth than the rest of the population, judging by the quality and size of their residences, the diversity of artifacts associated with their houses, the opulence of their tombs, and their greater access to prestige goods exchanged by the Maya with peoples of adjacent or distant regions. The peasants, who provided the agricultural support and physical labor necessary to maintain and enlarge the centers, lived in and around the epicenter, in groups of residential units characterized by low stone platforms with superstructures of perishable materials.

Early Preclassic Period (2500–900 BCE)

Knowledge of the Early Preclassic in Peten and Belize remains somewhat sketchy, but some sedentary agricultural villages likely existed in the central lowlands during this time. Some scholars propose that the Maya emerged as a culture independently, at about the same time as the Preclassic cultures of the Gulf of Mexico and the Guatemalan highlands.[2] Contrary to views that the Maya lowlands remained vacant until 1000 BCE, paleoecological studies point to the presence of horticulturalists as early as 3000 to 2500 BCE in some areas and by 1500 BCE in other parts of the Peten lowlands.[3] Archaeological excavations conducted at Cuello, in northern Belize, have revealed that the production of ceramics and the construction of stone buildings began during the last centuries of the Early Preclassic. Evidence also indicates that the earliest known instances of the practice of funerary rites among the Maya—under the floors of small housing platforms of this period, burials including ceramic vessels as offerings—have been detected.

Middle Preclassic Period (900–300 BCE)

The population grew gradually during the Middle Preclassic, and the construction of public buildings began to play a preponderant role. Notably, the construction of the first architectural complex of ceremonial character occurred in the region around 1100 BCE, an E-Group, or a set of buildings astronomically aligned to observe solstices and equinoxes. E-Groups consist of an elongated platform placed on the east side of a plaza, facing a pyramid on the west side. The earliest examples of this architectural pattern appeared in Peten at Uaxactun, Nakbe, El Tintal, and Tikal. The existence of such buildings indicates the emergence of a religious elite, who acted as mediators between gods and men, interceding especially with those deities that were believed to control agrarian cycles, such as Chahk, the rain god.

1 James A. Doyle, "El oro en la boca del ciempiés: Los artefactos centroamericanos del Cenote Sagrado de Chichén Itzá," in "El oro en Mesoamérica," special issue, *Arqueología Mexicana* 144 (March/April 2017): 42–43.

2 Richard D. Hansen, "Perspectives on Olmec-Maya Interaction in the Middle Formative Period," in *New Perspectives on Formative Mesoamerican Cultures*, ed. Terry G. Powis (Oxford: Archaeopress, 2005), 51–52.

3 Jeanette E. Castellanos and Antonia E. Foias, "The Earliest Maya Farmers of Peten: New Evidence from Buenavista-Nuevo San José, Central Peten Lakes Region, Guatemala," *Hindawi Journal of Anthropology* (2017): 2, https://doi.org/10.1155/2017/8109137.

Long-distance trade began around 1000–700 BCE. The appearance in the Maya lowlands of obsidian from the source at El Chayal, in the Guatemalan highlands, ranks among the earliest evidence that demonstrates the existence of such commerce.[4] Additionally, shell from the Caribbean as well as jade, granite, and basalt from the Guatemalan highlands have been found in many of the ceremonial centers of this period, such as Cuello and several sites in Peten, including Ceibal, Nakbe, El Mirador, Tikal, Altar de Sacrificios, Uaxactun, and Cival.

The earliest Maya lowland ceramics, known as pre-Mamom, emerged at this time. Far from homogeneous, pre-Mamom pottery comprised at least six different ceramic traditions. The first, known as the Xe ceramic complex, developed in Guatemala to the west of the La Pasión River. The second has been identified in the central region of Peten, between Tikal and Uaxactun, and is known as the Eb ceramic complex. The third tradition, corresponding to the region of the Yaxha and Sacnab lakes in the Peten basin, has been named the Ah Pam ceramic complex. The fourth was located in the region of El Mirador and has been designated the Ox ceramic complex. The fifth pre-Mamom ceramic tradition included the Cunil complex, which occurred in the Belize River valley, as well as the Swasey complex of northern Belize (fig. 1). Finally, the sixth ceramic tradition encompasses works from Holmul, in Guatemala, and the Ek complex of the Komchen region, in the Mexican state of Yucatan.

4
Kazuo Aoyama, "Preclassic and Classic Maya Interregional and Long-Distance Exchange: A Diachronic Analysis of Obsidian Artifacts from Ceibal, Guatemala," *Latin American Antiquity* 28, no. 2 (June 2017): 221–24.

Fig. 1
Graphic reconstruction of the vessels of the Cunio phase from Cahal Pech (top) and vessels from the Eb phase from Tikal, Guatemala (bottom), by Ajax Moreno, courtesy of the New World Archaeological Foundation

Between 1000 and 600 BCE, the social organization of the main ceremonial centers of central Peten reached a level of complexity suggesting the existence of early states. The most important centers of this time, such as Nakbe, El Mirador, El Palmar, Ceibal, and other sites in the Holmul region, seemed to emerge alongside public architecture. In particular, Nakbe has provided the best evidence of the beginnings of civic-religious monumental constructions hitherto found in the lowlands. Between 600 and 400 BCE, this site was transformed into a ceremonial center of monumental scale through the construction of two massive basal platforms, which reach heights of about 105 and 148 feet (32 and 45 meters), as well as a series of terraced structures whose heights range between 13 and 59 feet (4 and 18 meters). Monumental causeways, up to 8 miles (13 kilometers) long, were also built, to connect the main centers of the El Mirador region during the Middle Preclassic period.

Late Preclassic Period (300 BCE–150 CE)

During the Late Preclassic, social complexity continued to develop. Due to archaeological and epigraphic evidence that shows the existence of kings in some of the main centers of the Maya lowlands, this period has provided the most information regarding the beginning of the Maya states. A considerable demographic increase occurred during the last centuries of the first millennium BCE. At the same time, the proportion of the population involved in agricultural work increased.

One of the most important characteristics of this period was the unification of ceramics into a style classified as the Chicanel sphere, which had a typological stability that varied very little over six centuries, from 600 BCE to 1 CE. Within the ceramic inventory of this period, the presence of the utilitarian Zapote Striated type warrants mentioning, and Sierra Red, Polvero Black, and Flor Cream monochrome types, as well as dichrome ceramics, present uniformly in all the sites of the Maya lowlands. A waxy surface finish and decoration with parallel grooves or vertical and horizontal incisions characterize these wares (fig. 2); some more complex incised designs were also executed at this time.

To date, the most dramatic evidence regarding the emergence of early state societies in the central lowlands has been provided by centers in present-day Guatemala such as Nakbe, El Mirador, Uaxactun, and Tikal, as well as Calakmul, in Mexico, and Lamanai, in Belize. The monumentality and extension of ritual buildings such as the Lost World Pyramid (5C-54) of Tikal, the High Temple (N10-43) of Lamanai, and especially El Mirador's La Danta and El Tigre complexes—which rise around 236 and 180 feet (72 and 55 meters), respectively—serve as impressive examples of the organizational complexity of the Maya elite during the Late Preclassic period (fig. 3). In fact, Nakbe, El Mirador, Uaxactun, and Lamanai may well have reached urban dimensions in the last centuries of the first millennium BCE. A little later, in Tikal, the transformation toward the development of nucleated urban centers—a feature that would characterize Classic Maya cities—began. Nakbe, the hegemonic center of the El Mirador region during the Middle Preclassic, was displaced by El Mirador during the Late Preclassic. The construction of monumental roads connecting El Mirador with other sites, possibly under its political control, further suggests the existence of a centralized government that oversaw kings or rulers. A set of dynasties seems to have installed itself firmly in power in several Maya centers during this era.

Fig. 2
Late Preclassic Chicanel-sphere red-slipped fluted vessel from Tikal, Guatemala, height: 16½ in. (42 cm), diameter: 13 in. (33 cm), MUNAE 9964, 1.1.1.1968

The main architectural complexes of the Preclassic period were built in plazas, with cut limestone blocks covered with stucco. Burials 166, 167, and 85 of the North Acropolis of Tikal clearly indicate the advent of the construction of vaulted masonry tombs to deposit the mortal remains of the first Maya rulers, along with numerous mortuary offerings. During the beginning of the Late Preclassic at Nakbe, El Mirador, Uaxactun, and El Tintal, an unusual effort was invested in the construction of monumental triadic groups, each of which consists of an enormous platform supporting three structures in its upper terrace—their symbolism seems to relate to the placement of the three stones of Maya creation mythology.[5] At Uaxactun, El Tiburón serves as a recently found example of such architectural complexes. Its impressive 49-foot-high (15 meters) T-shaped platform reaches lengths of 541 feet (165 meters) in the rear and 377 feet (115 meters) at the front, encompassing around 12,565 cubic feet (356 cubic meters) of volume.[6]

For the first time, carved stone monuments seem to portray important historical characters, such as rulers with epigraphic and iconographic elements symbolizing royal sovereignty, as can be seen on stelae of Nakbe, El Tintal, El Mirador, and Cival; engravings in the cave of Loltun, in Mexico; stucco sculptures in buildings at Uaxactun; and the murals of Tikal's tombs. On the other hand, the extraordinary murals at San Bartolo, in Peten, demonstrate the high quality achieved by the art of painting during this period. These works reveal that the Maya worldview was already established in this epoch, and that the ancient Maya sought, through the use of iconography, to create a connection between mythological and historical time. The inclusion of an early antecedent of the *ajaw* glyph, "noble" or "lord," in a scene depicting an enthronement demonstrates the existence of rulers in the Maya lowlands at this time (fig. 4).

5
Linda Schele and Khristaan D. Villela, "Creation, Cosmos, and the Imagery of Palenque and Copan," in *Eighth Palenque Round Table, 1993*, eds. Martha J. Macri and Jan McHargue (San Francisco: Pre-Columbian Art Research Institute, 1996), 15–30.

6
Milan Kováč et al., "El cetro de Uaxactun: Hallazgos recientes y el mensaje escrito en la parafernalia de un rey preclásico," in *XXIX Simposio de Investigaciones Arqueológicas en Guatemala, 2015*, eds. Bárbara Arroyo, Luis Méndez Salinas, and Gloria Ajú Álvarez (Guatemala City: Museo Nacional de Arqueología y Etnología, 2016), 63–64.

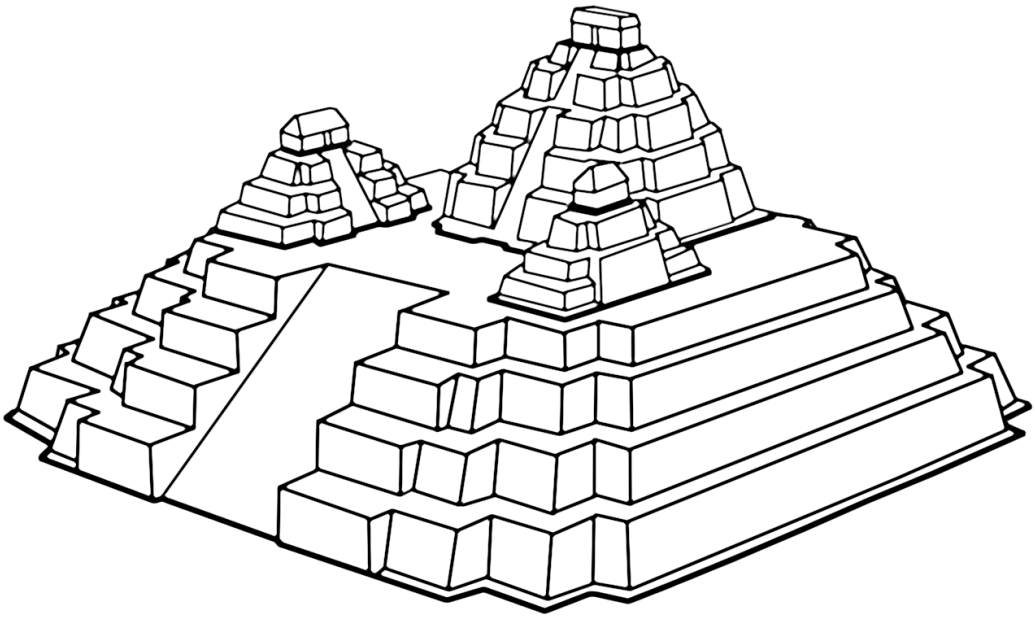


Fig. 3
Artistic reconstruction of El Tigre complex at El Mirador, Guatemala
(drawing by T.W. Rutledge; redrawn by James Doyle after Hansen 1992: fig. 23)

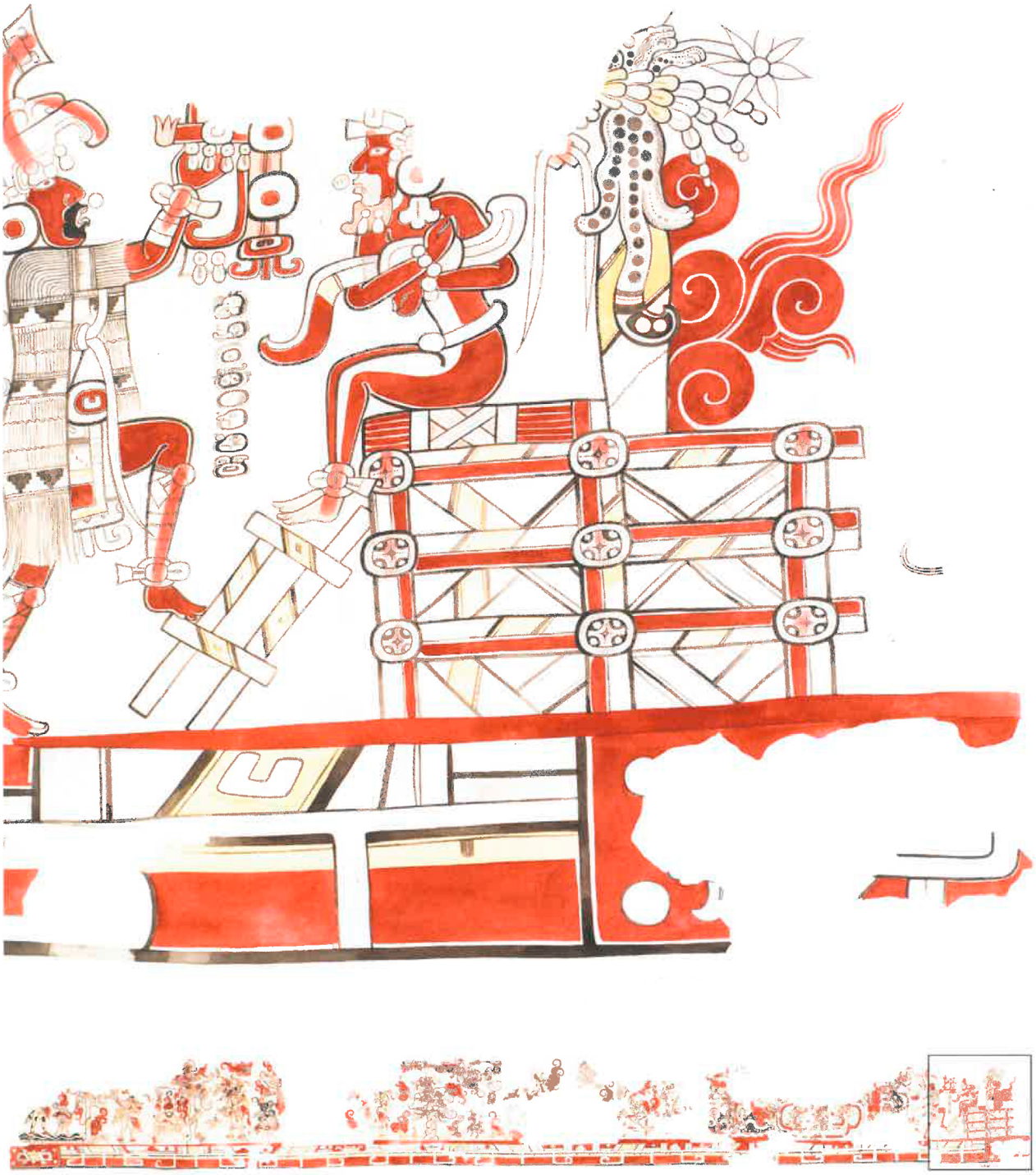


Fig. 4
Artwork 1 (SB Sub-1A NW mural color): San Bartolo Mural (illustration by Heather Hurst)

Terminal Preclassic Period (150–250 CE)

The Terminal Preclassic period, also described as Protoclassic, is characterized by a change in ceramic technology: the production of the first polychrome vessels and plates with mammiform supports (fig. 5). However, this type of Protoclassic pottery has been located only in some centers and in elite contexts. In general, the pottery inventory of this period consists of a mixture of Preclassic and Early Classic ceramics.

Nevertheless, the most important event during this period was the first Maya collapse, which possibly is due to a set of diverse factors such as climate change, wars, migrations, population pressure, and overexploitation of natural resources. The main centers of the El Mirador region were mysteriously abandoned, with the exception of El Tintal. At El Tintal, as well as at Becan, in southern Campeche, moats were built around the city center, possibly as a defensive mechanism. War may have been a crucial element in the development of sociopolitical complexity, forcing populations to group together for security.

Fig. 5
Terminal Preclassic tetrapod vessel with mammiform supports, Guatemala or Mexico, slip-painted ceramic ($10^{9}/_{10} \times 5^{4}/_{5} \times 5^{4}/_{5}$ in. [27.69 × 14.73 × 14.73 cm]), LACMA, purchased with funds provided by Camilla Chandler Frost, M.2010.115.394

Early Classic Period (250–600 CE)

The characteristic attributes of Classic Maya civilization crystallized during the Early Classic. Tikal and Uaxactun had become major Maya cities well before the start of this period, while Río Azul, also in the Peten basin, Caracol, in present-day Belize, and Holmul emerged as new and powerful polities. Although it is believed that the beginning of the Early Classic saw a decline in the demographic index of the central lowlands, most of the centers constructed during the era included hundreds of fine masonry structures, magnificent temples, causeways, large architectural complexes with palaces and administrative buildings, residential units, and lavish tombs.[7]

Tikal, in particular, became the center of the predominant polity in the central lowlands. Its advantageous location between the two major drainage systems of the nuclear zone likely gave this center a privileged position with respect to the East–West exchange networks between the Caribbean coast and the Gulf of Mexico. The prosperity of Tikal may also have derived from its close economic relationship with Teotihuacan, the great Mesoamerican metropolis of the Mexican highlands. The presence of Teotihuacan-like elements—such as tripod cylinders with rectangular supports (fig. 6), *talud-tablero* architecture, green obsidian, representations of the Mexican rain god Tlaloc, and other iconographic symbols—evinces intense cultural contact between Teotihuacan and Early Classic Maya centers (see cats. 12–15).[8]

Milestones of this era include the perfection of astronomical knowledge, the calendar, and arithmetic. The Maya developed a solar calendar of 365 days whose accuracy matched the Gregorian calendar of Western civilization, long before the invention of adequate apparatuses to observe the movement of the planets. Maya religious specialists, who acted as the keepers of knowledge in addition to performing ceremonial rituals, recorded the movements of the sun, the moon, Venus, and other celestial bodies. They were able to predict solar and lunar eclipses with high precision. These achievements likely related to the agricultural necessity of knowing with certainty the appropriate time of year to burn, sow, and harvest.[9] Other less tangible advances involved the implementation of institutions linked to social, political, economic, and religious organizations. A particular architectural feature also emerged at this time: the false, or corbeled, arch, a key characteristic of Classic Maya buildings.

During this epoch, the Maya began using polychrome paint on an orange engobe base, meaning they applied many different colors to decorate vessels with an orange background. Polychrome decoration became almost homogeneous for Maya potters, signaling the beginning of the Classic Period. Polychrome pottery ranked as a luxury item not commonly available to the general population. Figural polychromes were an elite prerogative, probably produced by and for the ruling class. The lidded basal-flange bowl emerged as a new style of pottery. A knob in the form of an animal or human head usually crested this type of vessel, with the painted body of the animal or human spread across the pot (fig. 7). Many of these vessels also rested on mammiform supports.

Near the end of the Early Classic period, between 534 and 593, the central lowlands, especially Peten, seem to have experienced a problematic period of a hitherto undetermined nature. Most of the region's centers suffered a hiatus, during which the dedication of carved monuments decreased or ceased.[10] Nevertheless, the construction of monumental buildings continued.

7 Robert E. Fry, "Disjunctive Growth in the Maya Lowlands," in *Precolumbian Population History in the Maya Lowlands*, eds. T. Patrick Culbert and Don S. Rice (Albuquerque: University of New Mexico Press, 1990), 291–93.

8 For the influence of Teotihuacan on Maya stucco-painted vessels, see Laura Maccarelli et al., "Postfire Painting," in this volume.

9 James J. Aimers and Prudence M. Rice, "Astronomy, Ritual, and the Interpretation of Maya 'E-Group' Architectural Assemblages," *Ancient Mesoamerica* 17, no. 1 (January 2006): 79–96.

10 Gordon R. Willey, "The Classic Maya Hiatus: A 'Rehearsal' for the Collapse?" in *Mesoamerican Archaeology: New Approaches*, ed. Norman Hammond (Austin: University of Texas Press, 1974), 417–30.

Fig. 6
Early Classic Teotihuacan-influenced lidded tripod cylinder with rectangular supports, Guatemala or Belize, slip-painted ceramic with postfire stucco and pigment (height: 8³/₄ in. [22.23 cm]; diameter: 7 in. [17.78 cm]), LACMA, purchased with funds provided by Camilla Chandler Frost, M.2010.115.24a–b

Fig. 7
Early Classic lidded vessel with supernatural jaguar knob, Peten, Guatemala, or Campeche, Mexico, slip-painted ceramic with postfire pigment (height: 12½ in. [31.75 cm]; diameter: 14½ in. [36.83 cm]), LACMA, purchased with funds provided by Camilla Chandler Frost, M.2010.115.1024a–b

Fig. 8
Late Classic cylinder vase with palace scene of a ruler from Dos Pilas, Guatemala

Late Classic Period (600–800 CE)

The golden age of Maya civilization corresponds to the Late Classic, a relatively short period of unusual expansion and vigor. Apart from the growth in size and complexity of the ceremonial centers, several other factors were coalesced so that the Maya could consolidate their status as a civilization. The political stage of the Late Classic period consisted of a number of highly competitive states that used emblem glyphs to distinguish themselves. However, there were marked differences between autonomous polities in the region with respect to their size, influence, and power.

During the Late Classic, Tikal became one of the biggest cities ever built by the Maya. Between fifty thousand and ninety thousand inhabitants resided in this center in the sixth century, as indicated by the presence of more than four thousand structures scattered over an area of approximately sixteen square kilometers. Five monumental temples were built in Tikal during the Late Classic, one of which, Temple IV, reaches 226 feet (69 meters) in height. Apart from the above, numerous monuments, temples, palaces, ceremonial platforms, residences, a steam bath, and five roads further testify to the splendor and power of this city.

Although Tikal and Calakmul fought for control of the central Maya lowlands during most of this period, other powerful polities also emerged, such as Naranjo, Piedras Negras, Dos Pilas, El Perú (known in Classic Mayan as *Waka'*), and Xultun in Peten, as well as Yaxchilan and Palenque in Chiapas. Huge pyramids crowned by small temples were built at those centers, as well as palaces with multiple rooms, sweat baths, and ballcourts.

Classic Maya civilization is well known for the excellence of its narrative and baroque artistic style, evident in particular in the monuments of the Usumacinta-basin cities, such as Piedras Negras. Beautiful and complex representations of people, supernatural beings, and animals appear on stelae, altars, thrones, wall paintings, jade and shell artifacts, and in codices, as well as in the stucco masks on the facades of the structures.

Fine polychrome pottery constitutes an additional achievement of this epoch. Refined, colorfully decorated ceramics were deposited as funerary offerings in the tombs of the elite. Inscriptions on many of these vessels identify their owners, the names of the people represented, and sometimes the artisan who painted them, as well as the liquids they contained. Artists developed an extensive repertoire of polychrome vessels that they painted with a variety of geometric and figural designs. These artists seem to have been sponsored by the royal courts of self-proclaimed divine rulers. Maya kings used fine ceramics as markers of their wealth and as diplomatic gifts to cement loyalty with local rulers.[11] Ceramics became the canvases of artists to create scenes with political, religious, or mythological connotations. Maya kings and queens, sitting on thrones, often impersonated deities through costume and performance, perhaps reenacting the mythological scenes on the painted pottery before them (fig. 8; see cat. 6). Other scenes painted on ceramic vessels show important aspects of elite Maya culture, such as ball games, musicians in action, ritual enemas, and the reception of tribute, among other subjects. Some vessels depict scenes of scribes writing, although not a single Classic codex has yet been found. The so-called codex style, likely produced around Calakmul and El Mirador, represents the pinnacle of calligraphic hieroglyphic writing and fine-line painting (fig. 9; see cats. 1–5).

The population of Classic Maya settlements ranged from several hundred to a few thousand in small towns, with tens of thousands in cities as large as Tikal. In order

11 Stephen D. Houston and Takeshi Inomata, *The Classic Maya* (Cambridge: Cambridge University Press, 2009), 278–79.

to sustain this high population density, in addition to slash-and-burn agriculture, the Maya developed a series of methods and techniques for intensive farming, such as constructing raised beds, cultivating the swampy *bajos*, and terracing hillsides. They also diversified crops to include orchards and fields of tubers and fruits.

The frequency of warlike conflicts between central Maya lowland polities grew substantially during the last centuries of the Late Classic period. In particular, the rivalry between Tikal and Calakmul, the two superpowers of the region, resulted in a series of collateral conflicts between other sites such as Caracol, Naranjo, Yaxha, El Perú-Waka', and Dos Pilas. In the Pasión River region, Dos Pilas established itself for some time as a powerful militaristic and expansionist center. Its ruling dynasty claimed genealogical connections with the reigning Tikal family, although it changed its alliance to Calakmul during the eighth century. These conflicts threatened the prestige of, and the people's trust in, the dynasties, changing forever some of the basic political institutions of Maya society.[12]

12
Arthur Demarest, *Ancient Maya: The Rise and Fall of a Rainforest Civilization* (Cambridge: Cambridge University Press, 2004), 262–68.

Fig. 9
Late Classic codex-style vase recording the dynastic sequence of the Kaanul royal family

Fig. 10
Terminal Classic modeled-carved vessel depicting God L, Belize, Guatemala, Honduras, or Mexico, slip-painted ceramic (height: 6 1/2 in. [16.51 cm]; diameter: 3 5/16 in. [8.41 cm]), LACMA, purchased with funds provided by Camilla Chandler Frost, M.2010.115.762

Terminal Classic Period (800–900 CE)

During the short Terminal Classic period, the Maya centers of the central lowlands suffered dramatic decline, culminating in the collapse of the Classic Maya sociopolitical system. In the century preceding that collapse, Maya civilization endured severe ecological imbalance, overpopulation, invasions, artistic and architectural decline, weakening of the power structures of sociopolitical institutions, migration, and, ultimately, the abandonment of most of its main cities.

In order to face this crisis, the elites made some structural changes, as suggested by the atypical flowering of Ceibal, a Maya center in the Pasión River region. While the majority of nearby polities collapsed, Ceibal enjoyed a construction and population boom during this period. One hypothesis suggests that the arrival of the Putun, a group of invaders who came from the Chontalpa, in present-day Tabasco, might have precipitated this situation.[13] This interpretation relies on the fact that the Terminal Classic monuments of Ceibal show characters with non-Classic Maya and Mexican glyphs; in addition, Ceibal adopted architectural modes with foreign connotations, and fine gray- and orange-colored ceramics, related to a different pottery tradition, have been found at the site (fig. 10). However, there is another explanation that points out that the adoption of sculptural and architectural styles supposedly foreign to Ceibal might simply reflect the authority and prestige claimed by local rulers through the use of symbols of mostly Maya origins.[14]

In any case, the socioeconomic transformations experienced at Ceibal failed, as evidenced by the abandonment of the center around 950 CE. Thus, in less than a hundred years, classic Maya civilization collapsed precipitously. From the middle of the ninth century, the construction of civic, ritual, and residential structures ceased. In addition, the optimal exploitation of agricultural potential that the Maya had managed to develop in the central lowlands for two millennia came to an end. The manufacture, distribution, and exchange of traditional prestige goods, such as quetzal feathers, fine ceramic artifacts, jade, wood, bone, and shell, also disappeared.

In the absence of consensus on the most relevant cause of the collapse, scholars have argued that it occurred as a gradual phenomenon caused by a series of interrelated factors that, together, provoked the weakening of Classic Maya civilization until it fell. Thus, various interpretations take into account factors such as internal wars, invasions, plagues, natural catastrophes, overpopulation, depletion of resources due to overexploitation, and the interruption of extra regional commercial networks.[15]

A few years after the Maya collapse, whatever its nature, the rainforest of the region covered the plazas and temples where the population had gathered to celebrate impressive civic-religious ceremonies. In search of better horizons, the surviving populations of the cataclysm of the central Maya lowlands went north until they reached the Yucatan Peninsula, where they would temporarily enjoy a period of resurgence until the arrival of the Spanish conquistadores in the sixteenth century.

13 Jeremy A. Sabloff and Gordon R. Willey, "The Collapse of Maya Civilization in the Southern Lowlands: A Consideration of History and Process," *Southwestern Journal of Anthropology* 23, no. 4 (Winter 1967): 311–36; John A. Graham, "Aspects of Non-Classic Presence in the Inscriptions and Sculptural Art in Seibal," in *The Classic Maya Collapse*, ed. T. Patrick Culbert (Albuquerque: University of New Mexico Press, 1973), 207–19.

14 David Stuart, "Historical Inscriptions and the Maya Collapse," in *Lowland Maya Civilization in the Eighth Century A.D.*, eds. Jeremy A. Sabloff and John S. Henderson (Washington, D.C.: Dumbarton Oaks Research Library and Collection, 1993), 336–44.

15 Culbert, *The Classic Maya Collapse*.

10 Shaped Pots, Painted Surfaces: The Artistry of Ancient Maya Potters and Painters

Megan E. O'Neil

Using crafting techniques such as sculpting, incising, and burnishing, along with slip-based painting and postfire painting on stucco, ancient Maya ceramic artists developed a low-fire ceramic tradition of great complexity and diversity. Artists adorned fine ceramic vessels with clay slips mixed with ubiquitous iron-based minerals that were applied before firing, and with rarer minerals such as malachite and pigment recipes like Maya blue, painted after firing. This essay elucidates how Maya artists manifested the cosmos in their shaping, painting, and firing of clay to make these ceramic works. Furthermore, it considers the artistry of Maya potters and painters, exploring current knowledge about the relationship between these artists and probing the choices they made concerning forms, materials, and manufacture.

This essay draws from the collaborative research of the Maya Vase Research Project, an undertaking of LACMA's Conservation Center and the Department of Art of the Ancient Americas, combining insight gained from technical analysis of ancient Maya ceramic vessels with knowledge derived from the images and texts on Maya objects, as well as Maya religion and languages. Through research about materials and techniques, contemporary scholars can come closer to the hands of the artists who made these ceramics—in some cases, literally, as in a radiograph of the floor of the *Vase of the Eleven Gods*, which reveals evidence of the potter's fingerprints pressed into the clay (fig. 1; cat. 10). Contextualizing this information with methods in art history, archaeology, epigraphy, and religious studies provides new understandings of the cultural meaning of these practices.

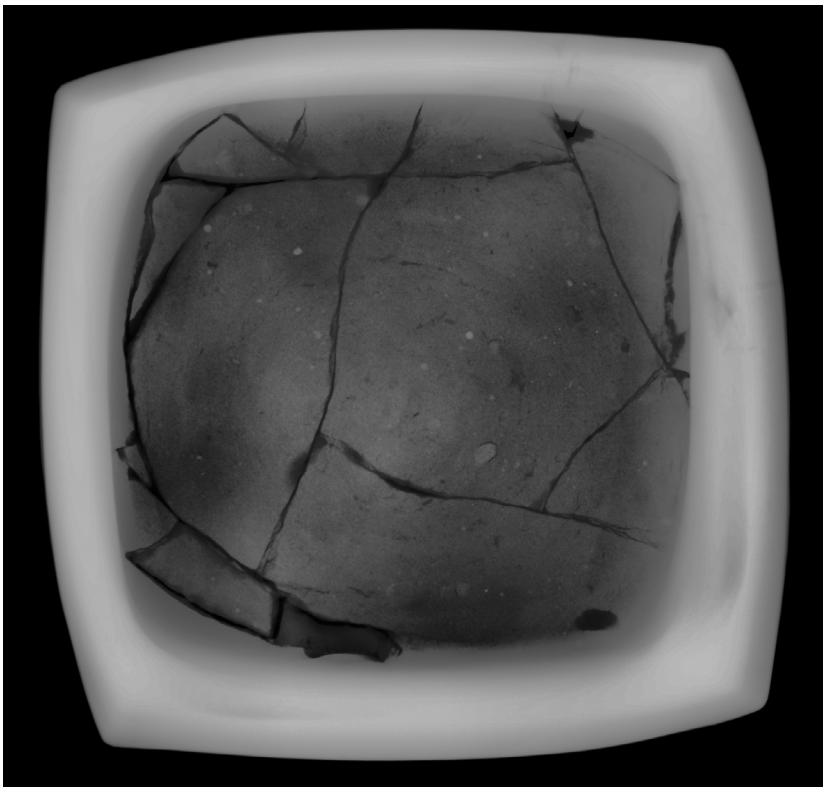


Fig. 1
X-radiograph of the bottom of the *Vase of the Eleven Gods* (cat. 10) showing dark elliptical impressions from the potter's fingers

Mythology and Manufacture

During the Classic period (250–900 CE), the Maya regarded art and writing as sacred acts used to depict and describe people, deities, and actions as well as to connect humans to the divine. Representations of scribes or artists render them in the form of deities, anthropomorphic rabbits or monkeys, and humans.[1] However, even when portrayed as human, they display characteristics associating them with the supernatural, such as mirror signs on their skin or water lilies in their headdresses. Likewise, a carved bone from Tikal, in present-day Guatemala, features a painter's hand emerging from a solar centipede portal, indicating that the artist's hand comes from the otherworld and suggesting the divine origin of artistic inspiration (fig. 2).

The Maya likewise regarded deities as artisans. The authors of the *Popol Vuh*, a creation myth recorded in the sixteenth century by K'iche' Maya nobility, describe the creator deities as *tz'aqol* (framer) and *b'itol* (shaper), using titles of craftspeople. These primordial artisans created the world by measuring and establishing its four corners and sides.[2] Comparable Yucatec Maya narratives specify the order of this generative process as a counterclockwise movement through the four directions. From ancient times to the present, ritual participants have reenacted this motion in world-renewal ceremonies involving circumambulation.

After making the world, the primordial artisans set out to make people. Failing to create humans from unfired clay and wood, they successfully produced people—who could speak and worship the deities—by shaping maize dough into figures and giving them breath. By naming the deities as artisans, the *Popol Vuh* authors connected them to living craftspeople, who re-created divine work whenever they fashioned spaces, buildings, objects, and images. Evidence suggests that these concepts significantly predate the colonial-period manuscript, and that the Classic-period Maya also perceived artists' actions as emulating those of divine artisans.

Maya potters and painters obtained clay and pigments from the sacred earth and shaped these materials by hand, analogous to the primordial artisans who worked with unfired clay, wood, and maize dough as they experimented in creating the first humans. Ancient Maya artists predominantly built clay vessels with a coiling technique, which involved laying down ropes of clay in a circular formation and turning the vessel to join and shape the coils. The circular motion of coiling clay vessels evokes the circumambulation of Maya ritual practice from ancient to contemporary times, which both recalls the divine creation of space and constitutes part of world-renewal rites.

Ancient artists also shaped and painted images of deities such as the Maize God, thereby making them manifest. Furthermore, they painted dedication texts around the rims of cylinder vessels; this act sanctified the vessel and encouraged its turning, or circular rotation, causing the handler to participate in world renewal. After shaping the clay, they transformed the vessels with fire. The firing was, of course, practical because it changed the shaped clay into an enduring object (unlike the failed version of humans from the *Popol Vuh*, who melted in the rain), but fire also would have held meaning because of its ubiquitous role in Maya ritual practice.[3] Finally, artists adorned some vessels, either initially or over time, by adding a painted band or covering the entire vessel in Maya blue, which enveloped them in preciousness. The labor of ancient ceramic artists combined practical and ceremonial elements. When making these vessels, they re-created and renewed their cosmos.

1 Dorie Reents-Budet, *Painting the Maya Universe: Royal Ceramics of the Classic Period*, exh. cat. (Durham, NC: Duke University Press in association with Duke University Museum of Art, 1994); Takeshi Inomata, "The Power and Ideology of Artistic Creation: Elite Craft Specialists in Classic Maya Society," *Current Anthropology* 42, no. 3 (June 2001): 321–49.

2 Allen J. Christenson, *Popol Vuh: The Sacred Book of the Maya* (Winchester, UK: O Books, 2003).

3 Regarding fire rituals among the Late Classic Maya, see David Stuart, " 'The Fire Enters His House': Architecture and Ritual in Classic Maya Texts," in *Function and Meaning in Classic Maya Architecture*, ed. Stephen Houston (Washington, D.C.: Dumbarton Oaks Research Library and Collection, 1998), 373–425.

Fig. 2
Carved bone showing an artist's hand emerging from a solar centipede portal, c. 734 CE, Burial 116, Tikal, Guatemala, K8154C

Making and Painting

The Classic-period Maya called artists *its'aat* (wise person) or identified them by their practice. For example, *ahtz'ihb* (writer or painter) referred to those who painted with a brush or quill pen. The root *tz'ihb* (paint or write) appears in dedication texts painted on the rims of many polychrome vessels (see, for instance, cats. 18, 22), identifying the act of painting that completes or sanctifies the object.[4] Often, dedication phrases indicate a vessel's intended contents—such as *kakaw* (chocolate) or *ul* (maize gruel, called *atole* in Spanish)—and its owner. *Utz'ihb* (his or her writing or painting) also can appear in an artist's signature painted as a separate text, at times in a significant location. On a cylinder vessel depicting a palace scene, the artist's name is painted just behind the feathered headdress of the enthroned ruler or prince (cat. 6); on the *Vase of the Eleven Gods*, it appears in front of one of the deities and next to a creation text concerning the ordering of gods at the start of a new temporal cycle, such that the painter's name seems almost a part of that divine list (fig. 3; cat. 10).

But what about the person who formed the clay vessel? Were the potters and painters the same artists? And how did they relate to each other? Specific titles designate those who carved images and texts onto stone sculptures or ceramics, such as the carved vessels of the Chochola style. Some have deciphered the word as *yuxul*, or *yul*, deriving from words for slicing, cutting, or polishing, but this reading remains contested.[5] Regardless, the phrase refers to the type of decoration, carving versus painting, specifically on the surface of the thing—*tz'ihbnaj yich* (writing on the surface)—so it seems not to apply to the builders of the vessels. Dorie Reents-Budet and Ronald L. Bishop have argued that even if potters and painters were different individuals, they likely maintained close relationships, because the potting and painting would have needed to occur in the same locale to reduce opportunities for damage to the fragile, unfired clay forms. Furthermore, they contend that the recipes for the clay body and slips had to be conceived together in order to ensure that they would adhere properly.[6] Even if potting and painting constituted distinct artistic vocations, practitioners of each craft may have worked in the same locale in teams laboring in sequence.[7] Looking closely at the vessels themselves affords further exploration of the relationship between or among these artists. For some vessels, the potter made specific decisions to plan for painted designs, and certain forming techniques meaningfully corresponded to the painted images. Other vessels appear to have been made without such consideration and may have been painted by artists not involved in shaping the clay.

Fig. 3
Detail of the *Vase of the Eleven Gods* (cat. 10) showing the artist's signature near a list of deities

4 Stuart, "Hieroglyphs on Maya Vessels," in *The Maya Vase Book: A Corpus of Rollout Photographs of Maya Vases*, vol. 1, ed. Justin Kerr (New York: Kerr Associates, 1989), 149–60.

5 Stephen Houston, "Crafting Credit: Authorship among Classic Maya Painters and Sculptors," in *Making Value, Making Meaning: Techné in the Pre-Columbian World*, ed. Cathy Lynne Costin (Washington, D.C.: Dumbarton Oaks Research Library and Collection, 2016), 392–93.

6 Reents-Budet and Ronald L. Bishop, "Classic Maya Painted Ceramics: Artisans, Workshops, and Distribution," in *Ancient Maya Art at Dumbarton Oaks*, ed. Joanne Pillsbury et al. (Washington, D.C.: Dumbarton Oaks Research Library and Collection, 2012), 293.

7 James Doyle, "Creation Narratives on Ancient Maya Codex-Style Ceramics in the Metropolitan Museum," *Metropolitan Museum Journal* 51 (2016): 47.

For sculpted vessels, the design consists primarily in the potting and sculpting, and slip-based painting may provide a uniform color, as in a lidded vessel of an armadillo with a Fat God face in LACMA's collection (M.2010.115.953a–b). The artist shaped the armadillo's body in three dimensions. The bowl and rounded lid form the shell, with added incising to delineate the armor. This vessel bears no signature, but because the sculpting constitutes the primary fabrication and decoration, and painting it entirely with one color likely required no additional specialization, one could hypothesize that the potter and painter were likely the same person. Other works in the museum's collection, such as an offering bowl on four feet (M.2010.115.888a–b), seem suited to an analogous workflow. The lid comprises the upper body of the rain deity Chahk—recognized by his serpentine face and cut-shell earflares. He wears an elaborate necklace, which is incised into the vessel's lid. Incised supernatural serpent heads adorn the bowl's exterior walls, and the feet take the shape of the heads of peccaries, whose flattened snouts firmly support the vessel. Integrating form and function, the firing vents for the hollow feet double as the peccaries' mouths. This sculpted form was painted with brown-black slip before firing, but the shaping of the pot constitutes the primary design feature.

But what about vessels with more intricate painted imagery or named painters? One way to start addressing this relationship between potters and painters may be to look at the importance of precision in forming the vessel in comparison with precision in painting. Some vessels show great precision in their manufacture. The radiograph of a vessel with a pedestal base from Guatemala's northern Peten or southern Campeche, in Mexico, shows an elegant structure, with even walls from careful potting (cat. 18).[8] The precise painting also reveals careful rendering of every element. Others show less precision in forming the pot. The radiograph of a tall cup from the northern Peten reveals unevenness in the rim and an inconsistent wall thickness throughout (cat. 3). The painting, however, demonstrates careful and detailed execution, with washes in dark brown and black as well as various weights of line composing a representation of the Maize God in avian form. Did the painter and potter work together? This is not apparent.

At the same time, this vessel forms part of a set with a comparatively squat and wide bowl painted with similar images. Reents-Budet and colleagues have noted that the same clay may have been used for the cup and the bowl (cats. 3 and 4).[9] Similar mixtures of nonplastic inclusions also become apparent in the radiographs. The images show that both vessels were hand built with coils, but their facture varies slightly. Although the cup walls exhibit uneven thickness, those of the bowl appear uniform. This may indicate the work of two potters, or perhaps a single potter could more easily control the shaping of the low bowl.[10] Regardless, one painter painted both and adjusted the design between the two vessels, adapting the imagery to their respective shapes. The fact that they were created as a set with similar clay bodies suggests communication and planning.

Whether or not they participated in the planning of vessels, Maya painters fluidly responded to particular shapes, large and small. A cylinder vessel intricately decorated with a scene of the dance of the Maize God exemplifies a painting style from northeastern Guatemala (cat. 21). This especially small cup stands only six and a half inches tall with a diameter of three inches, but the artist creatively accommodated the scene without sacrificing meaning. Usually, artists paired each Maize God in this type of scene with a dwarf. Another vessel in this book's study set, for instance, shows two Maize Gods and two dwarfs (cat. 24). On the smaller vessel,

8 See John W. Hirx and Megan E. O'Neil, "Building the Ceramic Vessel," in this volume.

9 Reents-Budet et al., "Codex-Style Ceramics: New Data Concerning Patterns of Production and Distribution" (paper, XXIV Simposio de Investigaciones Arqueológicas en Guatemala, Museo Nacional de Arqueología y Etnología, Guatemala City, July 19, 2010), 8.

10 See Hirx and O'Neil, "Building the Ceramic Vessel."

however, one dwarf appears between two Maize Gods, effectively serving as the dancing partner for both (fig. 4). The Maize Gods wear large, elaborate feathered backracks and dance to celebrate their rebirth and inaugurate the world. The artist avoided abbreviating the Maize Gods' elaborate attire, which is crucial to the meaning. By eliminating one dwarf, the painter made a visual abbreviation that still preserves the significance of the scene. Indeed, because of the circular composition, which encourages a user to turn the vessel, the experience of paired dancing persists. As a user rotates the vessel, he or she activates the image and the Maize God's circular dance.

The dedication text is also abbreviated. It begins with a dedication verb, likely *t'abay* (it is raised), but lacks a *tz'ihb* passage. Instead, it proceeds to the passage that designates the drinking vessel for *ixim-te'el kakaw*, which may specify a particular type of chocolate or refer to a symbolic connection between chocolate and maize.[11] On the other hand, the statement of ownership, identifying a royal woman from Baax Witz, or Xultun, in northern Guatemala, comprises a long passage that takes up about half the circumference, suggesting her importance. The textual abbreviation thus avoids sacrificing the owner's name without loss of meaning, because a knowledgeable scribe or user could recognize the elision of these standard phrases. Nonetheless, whether the painter conceived this response to the vessel's shape from the beginning of its manufacture remains inscrutable.

11 For a discussion of the types of chocolate mentioned in dedication texts on Maya ceramics, see Stuart, "The Language of Chocolate: References to Cacao on Classic Maya Drinking Vessels," in *Chocolate in Mesoamerica: The Cultural History of Cacao*, ed. Cameron L. McNeil (Gainesville, FL: University Press of Florida, 2006), 184–201.

Fig. 4
Two views of a cylinder vessel (cat. 21) showing a single dwarf in relation to two Maize God dancers. Visible in the right-hand image is only the backrack of a second Maize God dancer.

Fig. 5
Vessel in the shape of a house with palace scene, 750–850 CE, collection of the Flemish Community, inv. no. VG-169

Planning Designs

On the other hand, evidence from other vessels indicates that potters made specific decisions to plan for the painted designs, and that certain forming techniques meaningfully related to the painted images. A footed vessel that likely originated in or around Motul de San José, Guatemala, takes the shape of a building, its bulging roofline painted with thatch (cat. 17). Within this building unfolds a supernatural palace scene portraying the birth of the primordial cacao tree.[12] Radiographs reveal that this vase was built with stacked coils and that the ridges around the vessel's neck—forming the roofline—were shaped during the building of the wall rather than added later. This minor detail belies larger implications: It suggests that the painted design was planned during the coiling. Indeed, the potter and painter were either one and the same or worked together.

This becomes more intriguing when compared with a vessel in the collections of the Museum aan de Stroom in Antwerp, Belgium (previously in the Dora Janssen collection; fig. 5). Both vessels portray an architectural space in which two seated anthropomorphic figures occupy a bench above steps and a floor where other figures stand, and both include a vertical architectural element functioning as a pillar or doorway. In addition, the two vessels represent houses or temples, with a thatched roof rendered in three as well as two dimensions, modeled as a protruding ring in the upper part of the vessel and painted with thatch designs.[13] Whereas the LACMA vessel portrays a supernatural palace scene, the Antwerp vessel depicts a human analogue, with offerings of a tied cloth bundle and tamales. The two vessels create a pairing, one supernatural, the other human, both with themes relating to materials of trade and tribute, such as textiles, feathers, and chocolate. Indeed, they likely were made in conjunction with each other and with the plan of the paintings in mind.[14] Moreover, the painter's hand appears to be the same. One can hypothesize that they were made by the same potter and decorated by the same painter, and that, in both cases, planning of the painted images occurred during the potting stage.[15] Likewise, James Doyle has identified two codex-style cups, one in the Princeton University Art Museum in New Jersey, the other in the Metropolitan Museum of Art, New York, as the work of the same potter and the same painter.[16] Investigating the practice of making pairs or sets of vessels could further current understanding of the process through which ceramic artists conceived designs.[17]

Similarly, the squared *Vase of the Eleven Gods* (cat. 10), which represents a four-sided palace that emulates the cosmos, likewise shows simultaneous planning of potting and painting. Ten deities with solar and avian attributes, seated in two registers, face the cigar-smoking God L, who sits on a throne inside a mountain or cave. The text states that the gods are ordered on 4 Ajaw 8 Kumk'u, the start of a new cycle of time, when the creation or renewal of the world takes place. This square shape is rare among Maya vessels. Radiographs show that the potter built the vessel with coiling, starting with a spiral in the floor.[18] Although fashioning a squared vessel presents greater difficulty than creating a cylinder, the potter (and painter) selected the shape to represent the four-sided palace and cosmos. At the same time, the coiling echoes—and may have constituted a form of—ceremonial circumambulation, the essential ritual movement for world renewal. Thus the potter emulated world creation and manifested world renewal in the spiral floor and coiling, much like the painter made visible and material the scene of the gods at that significant moment. In this manner, the method of manufacture may have carried as much meaning as the painted scene. Moreover, the painting and the vessel's construction are integrated.

12 Simon Martin, "Cacao in Ancient Maya Religion: First Fruit from the Maize Tree and Other Tales from the Underworld," in McNeil, *Chocolate in Mesoamerica*, 154–83.

13 The pink painted on some of the glyphs of the Antwerp vessel is characteristic of Ik'-style painters of the kingdom centered at Motul de San José, from which both vessels may originate.

14 Other vessels in this set or series are in the Jay I. Kislak Collection at the Library of Congress, Washington, D.C., and portray more aspects of the mythological chocolate scene. Martin, personal communication, 2018.

15 In-person examination of the Antwerp vessel and a radiograph to compare to the LACMA vessel would be required to verify this hypothesis.

16 Doyle, "Creation Narratives," 53.

17 See Mary E. Miller, "The Trouble with Sets: Renewing the Contexts of Maya Vessels," in this volume.

18 See Hirx and O'Neil, "Building the Ceramic Vessel."

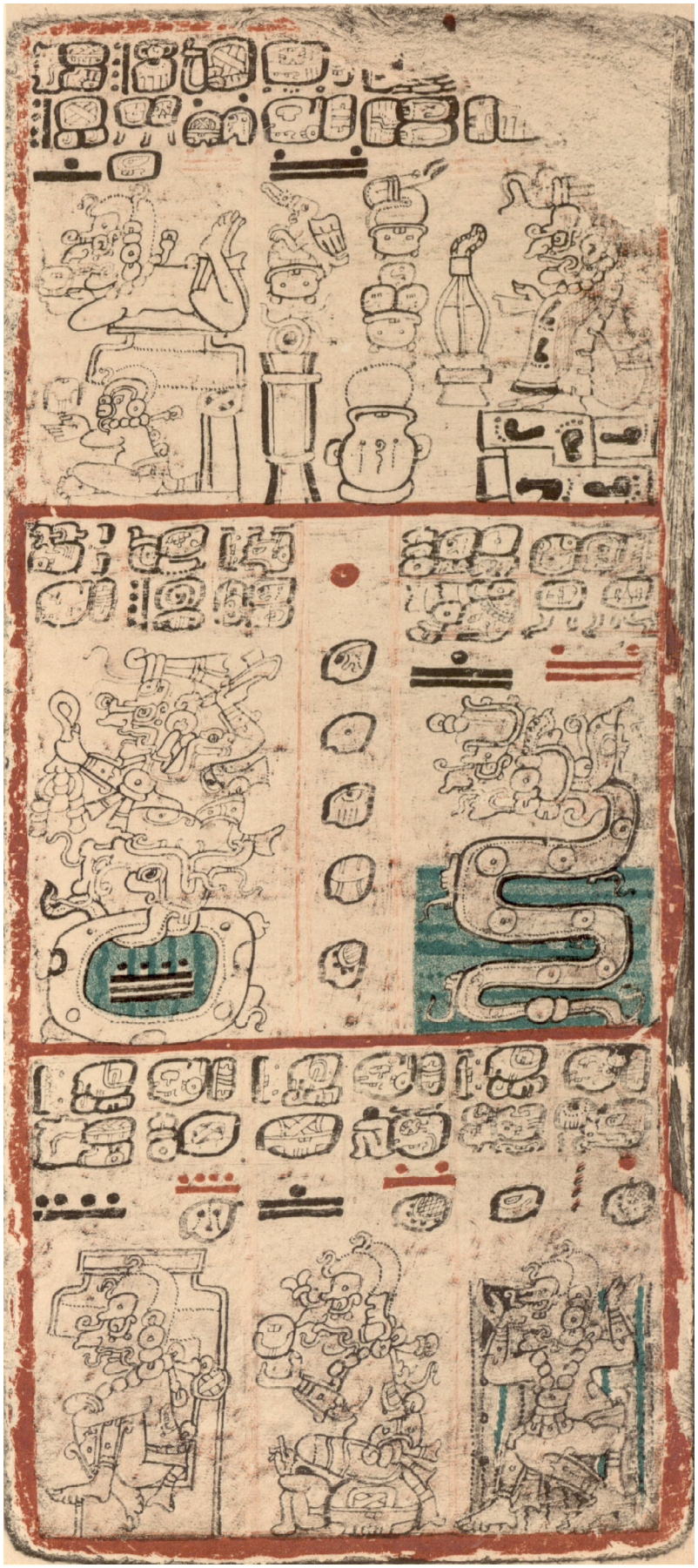


Fig. 6
Page 38 of the Dresden Codex, c. 1200–1250, Sächsische Landesbibliothek, Staats-und Universitätsbibliothek Dresden (Mscr. Dresd. R 310, photograph of Ernst Förstemann facsimile by Linda Schele, David Schele, courtesy of Ancient Americas at LACMA, ancientamericas.org.)

As with the cacao-tree vessel mentioned above, the planning of the ceramic form anticipated the painting, and the painter took advantage of ceramic technologies to accommodate the representation of the mythological scene.

Other crucial aspects of the form of the *Vase of the Eleven Gods* lie in its proportions, which evoke the pages of a book, taller than they are wide, and its color application. Maya books from the Postclassic period (900–1539 CE), such as the thirteenth-century Dresden Codex, share a comparable aspect. Its pages were painted with a cream background before the application of black and red (or additional colors; fig. 6).[19] Codex-style vessels, painted with cream backgrounds and then black and red lines, derive their classification from this and other Maya manuscripts. Most of those vessels are cylindrical, and their images likely corresponded to those in contemporaneous books, though no such manuscripts survive. Furthermore, examination of the *Vase of the Eleven Gods* in comparison with Justin Kerr's pre-restoration photographs reveals that it was made first as a codex-style vessel, coated with a cream slip layer and then painted with black and red images and texts (fig. 7).[20] The black and red backgrounds, applied with slip around the already executed images and texts, came last. This book-like vessel, then, was initially painted as if pages of a book comprised its sides, thereby creating a significant dialogue between painted media. Moreover, the planning of the vessel's painting began with the potting stage, showing an important interrelation between potter and painter.

19 O'Neil, "The Painter's Line on Paper and Clay: Maya Codices and Codex-Style Vessels from the Seventh to Sixteenth Centuries," in *Toward a Global Middle Ages: Encountering the World through Illuminated Manuscripts*, ed. Bryan C. Keene (Los Angeles: J. Paul Getty Museum, 2019), 123–34.

20 Before the *Vase of the Eleven Gods* entered LACMA's collection, it was photographed and restored in the studio of Justin and Barbara Kerr. Barbara, a self-trained restorer, rebuilt and repainted the vessel. Justin photographed the *Vase of the Eleven Gods* after Barbara had rebuilt it but before she repainted it. His professional photographs reveal details obscured by the restoration.

Fig. 7
Pre-restoration photograph of the *Vase of the Eleven Gods* (cat. 10)

Meaning and Pigments

Finally, stucco-painted vessels constitute a category in which an even higher probability of a clear division of labor exists. Potters and painters may have worked together on such ceramics, but they may not have even known one another. Indeed, examples attest to the stucco painting of heirloom vessels at Teotihuacan, near Mexico City, and in the Maya area, including a slip-painted vessel excavated at Holmul, in present-day Guatemala, which was later covered with stucco and pigments.[21] In this instance, a painter crafted a design onto a vessel that already existed, but other vessels would have been made for stucco painting.

One seventh-century stucco-painted vessel, a small footed cup, features a magnificent scene of a rattle-bearing musician rising or being reborn from the centipede jaws of the underworld—the same portal through which the sun is reborn each morning (fig. 8; cat. 16). The technique and aesthetic of this painted vessel share connections with Maya mural painting of the Late Classic period (600–800 CE).[22] This scene most likely was painted by an artist other than the one who made the pot, although the connection between them, if any existed, remains unclear. Nonetheless, probing the pigments can deepen current understanding of the relationship between materials and the painted image.

After the firing, the vessel was painted with Maya blue, using a technique invented by the Maya to create brilliant blues denoting preciousness, water, and life. The present shade, a rich azure, perhaps denotes the morning sky. While the color may function representationally, it also may have served to envelop the vessel in preciousness or sacralize it, comparable to sixteenth-century Maya practices of painting objects blue before offering them in the Sacred Cenote of Chichen Itza, as described by Diego de Landa.[23] This may also explain why the artist first painted this entire vessel blue. In the areas where the figures would be rendered, the artist then painted a layer of calcite before applying shades of red and orange. These warm hues derive from cinnabar prepared in different concentrations with an iron oxide to create the color variation and layered with iron-based ocher to achieve additional tones and shading. This coloration gives volume to the figures' bodies, but not in the manner of a European chiaroscuro technique. Instead, the bursts of color both suggest volume and highlight certain corporeal features. The human figure's face, upper arms, and hands, for instance, seem almost to pulse with blood, and thus with heat and vitality.

The use of cinnabar, in particular, to invigorate these figures may hold meaning in relation to concepts of ancestors and rebirth. Cinnabar covers many royal Maya skeletons in tombs. María Luisa Vázquez de Ágredos Pascual and Linda R. Manzanilla Naim relay that cinnabar could have functioned as an insect repellant to delay decomposition, but they also address the use of cinnabar for healing, to balance heat and cold in living bodies.[24] By extension, tombs too may have been understood to heal the body, actually or symbolically, in preparation for resurrection. By painting the body red, the Maya also might have sought to make it resemble, in temperature and aspect, the red-hot bodies of Maya sun gods, perhaps in an effort to help the deceased resurrect as a solar deity. Thus, on this vessel, the pigment containing cinnabar manifests a figure who resurrects through the solar centipede portal. The painter may have chosen this pigment both for its potential in creating particular hues as well as for its meaning relating to healing and rebirth. Indeed, the materials and techniques used to make this painting played essential roles in creating its meaning, analogous to the vessels described above, in which the shaping of the clay significantly influenced the meaning of the vessel and its painted image.

21 Virginia M. Fields and Reents-Budet, *Lords of Creation: The Origins of Sacred Maya Kingship*, exh. cat. (Los Angeles: Los Angeles County Museum of Art, 2005).

22 See Laura Maccarelli et al., "Postfire Painting," in this volume.

23 Alfred M. Tozzer, *Chichén Itzá and Its Cenote of Sacrifice: A Comparative Study of the Contemporaneous Maya and Toltec* (Cambridge, MA: Peabody Museum of Archaeology and Ethnology, Harvard University, 1957), 211.

24 María Luisa Vázquez de Ágredos Pascual and Linda R. Manzanilla, "Corporate Paint and Ancient Pharmaceutical Mixtures from Teotihuacan: The Teopancazco Neighborhood Center," *International Journal of Pharmacovigilance* 1, no. 1 (2016): 9

This collaborative research brings to light multiple ways in which the ceramic artists of fine polychrome vessels chose and experimented with materials, forms, and manufacture and worked to integrate painted designs onto shaped pots. Although the relationship between potters and painters remains difficult to discern with certainty, evidence suggests that the planning of painted scenes often occurred with the conception and building of the vessel, indicating either that potters also painted their wares or that distinct artists worked together in the same or nearby spaces. These artists created beautiful and complex designs, some outstanding for their sculptural forms, some for their painted images and texts, and others for both. Labeled "wise people" and portrayed in the image of deities, Classic-period Maya ceramic artists possessed creative abilities and training that they used to record momentous occasions, make deities visible and manifest, and renew the cosmos, both through their production techniques and in the handling of finished vessels. Their work formed an integral part of elite Maya society, creating forms through which people communicated with one another as well as with ancestors and other supernatural beings.

Fig. 8
Detail of a rollout photograph of a tripod vessel (cat. 16) with supernatural musicians, enhanced to highlight a rattle-bearing performer rising from the centipede jaws of the underworld

11 In the Court of the Moon Gods: Maya Lunar Myths and the Patrons of Glyph C

Oswaldo Chinchilla Mazariegos

Finding uncommon imagery in an unprovenienced object is at once a treat and a challenge for students of ancient Maya art and writing. Misgivings about the object's authenticity temper the interpretive possibilities afforded by unusual representations and rare glyphic collocations. While gross falsifications betray themselves more readily, distinguishing alterations and misreconstructions of ancient objects by modern restorers present marked difficulties.[1] Limited access to the original objects requires scholars to depend on photographs and drawings of variable quality. Such secondary sources often gloss over the effects of restoration, which might cast doubt on iconographic and epigraphic interpretations. Through careful examination of the objects and modern imaging methods, however, researchers can confront the challenges posed by modern alterations, often with surprising results.

A cylindrical Maya vase from the Late Classic period (600–800 CE) in LACMA's collection, *Cylinder Vase with Moon Goddess and Celestial Beings* (fig. 1; cat. 7), illustrates one such scenario. A rollout photograph by Justin Kerr brought this vase to scholarly attention in the early 1990s.[2] The lunar connotations of the painted scene were evident: It portrayed not only the Moon Goddess with her rabbit but also a whole series of gods marked with lunar signs—the curved crescents that characteristically transpire like sweat from their armpits. While apparently well preserved, the painted surface of the vase shows evidence of breaks restored through infilling and overpainting. Departing from the more customary arrangement of hieroglyphic texts around the rim of Maya ceramic vessels, the vase bears hieroglyphic bands around both the rim and the base, featuring oddly spaced glyph blocks and unusual collocations. One might thus reasonably suspect that the restorer's brush had introduced elements that altered the original composition. A previously published drawing based on a high-resolution image, which Kerr generously provided (along with a warning regarding the overpainting), attempted to identify the affected areas, leaving them blank.[3]

The attempt was only partly successful. LACMA's technical imaging (particularly, infrared and ultraviolet imaging (figs. 2 and 3) and close examination of the original vase with ultraviolet light in 2016 showed that the overpainting occurred only in narrow, infilled stripes along breaks, with somewhat larger areas in the base and the rim, which, nevertheless, resulted in relatively small alterations of the hieroglyphic blocks. Modern paint also completes eroded parts of the design, especially in the legs of some of the standing characters, but alterations of the original design are relatively minor and did not significantly impact iconographic interpretation. As it turns out, the peculiarities of the text resulted largely from the ancient scribe's calligraphic idiosyncrasies. This artist was dexterous but far from masterful. His scribal peculiarities match the characters' graceless bodily features—overly long or too short arms, stiff hands, and blocky proportions. Despite its aesthetic shortcomings, the vase in its present condition remains a reliable source, and indeed, it opens an unparalleled window for the study of Classic Maya myths and beliefs related to the moon and the lunar gods.

1 Elizabeth P. Benson, organizer, *Falsifications and Misreconstructions of Pre-Columbian Art: A Conference at Dumbarton Oaks, October 14th and 15th, 1978*, ed. Elizabeth H. Boone (Washington, D.C.: Dumbarton Oaks, Trustees for Harvard University, 1982); Bryan Just, *Dancing into Dreams: Maya Vase Painting of the Ik' Kingdom*, exh. cat. (Princeton, NJ: Princeton University Art Museum; New Haven, CT: Yale University Press, 2012).

2 Maya Vase Database, K5166, http://research.mayavase.com/kerrmaya.html.

3 Oswaldo Chinchilla Mazariegos, *Imágenes de la mitología maya* (Guatemala City: Museo Popol Vuh, Universidad Francisco Marroquín, 2011), 208–9.

Fig. 1
Rollout photograph of the *Cylinder Vase with Moon Goddess and Celestial Beings* (cat. 7)

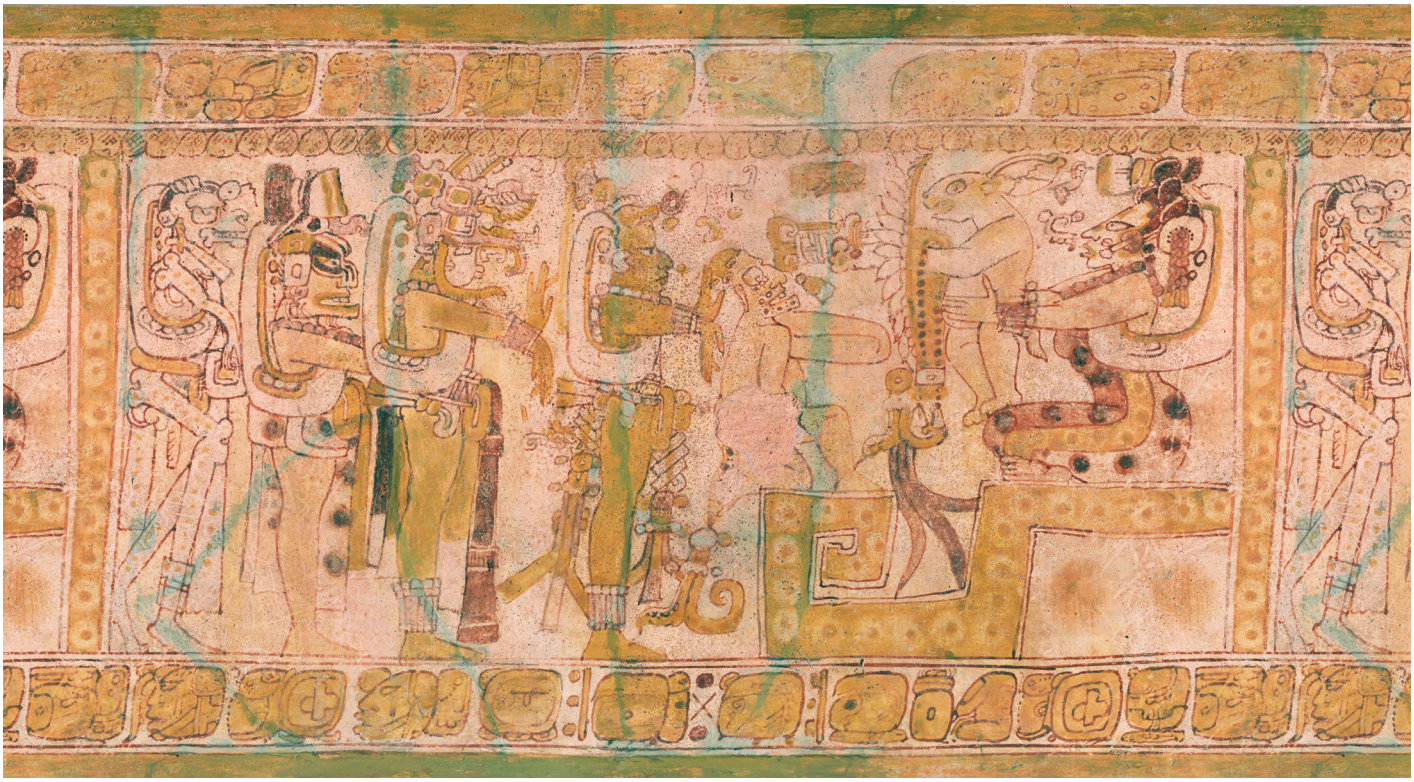


Fig. 2
False-color infrared rollout (FCIR) photograph of the *Cylinder Vase with Moon Goddess and Celestial Beings*

Fig. 3
Ultraviolet photographs of the *Cylinder Vase with Moon Goddess and Celestial Beings*

Fig. 4
Examples of Glyph C of the Lunar Series: (a) jaguar-god variant, Stela A, Quirigua, Guatemala; (b) jaguar-god variant, panel from El Cayo, Mexico; (c) jaguar-god eye variant, Tomb 1, Río Azul, Guatemala; (d) Maize God variant, Stela E, Quirigua, Guatemala; (e) Maize God variant, Stela F, Quirigua, Guatemala; (f) death-god variant, Stela 8, Dos Pilas, Guatemala

The Glyph C Gods

Within the vase's painted scene, the Moon Goddess presides over a curious gathering held in a palatial setting. She sits on a fret-shaped bench, holding in her arms an oversized rabbit that carries the hat and cape of God L. The denuded God L kneels humbly before the elevated lady and her bunny, while four lunar gods stand taut in a crowded group. The crescents in their armpits leave no doubt about the lunar character of the four onlookers, but who are they? While early studies provided hints about the complexity of Maya lunar beliefs and associated deities, scholars had little knowledge about the deities portrayed on this vase. With one exception, they can be identified with the Glyph C variants of the Lunar Series—a series of standardized glyphic collocations that described the age of the moon, the lunation number, and the name of the lunation for specific dates in Maya inscriptions dating to the Classic period (250–900 CE).[4]

Glyph C consists of the optional possessive prefix *u*, a numerical coefficient, and an extended hand that cradles a variable head glyph combined with a moon sign (fig. 4). In his 1920 treatise, *The Inscriptions at Copan*, Sylvanus Morley showed that the coefficient recorded the number of the lunation in a cycle of six and inferred that the variable heads corresponded to deity names.[5] Following his lead, in 1928, John E. Teeple suggested that these indicated "divinities to whom the particular moon was consecrated."[6] He elucidated the cycle of six numbered lunations denoted by Glyph C but could not explain the alternation of the deity heads. Their relatively small size complicated identification, and, for a long time, scholars wrestled with uncertainty about the number of deities represented by the Glyph C heads.[7] In an important 1993 contribution, John H. Linden established that there were only three, which he characterized as a "skull deity," "human deity," and "mythical deity."[8] As explained below, these gods are better characterized, respectively, as a death god, the Lunar Maize God, and a jaguar god. Linden also proposed that the combinations of six numerals and three deities derived from an eighteen-month lunar synodic calendar. Despite these findings, Glyph C remains undeciphered, although its meaning is broadly understood. David Stuart as well as Marc Zender and Joel Skidmore agree that it contains the subject of the verb *huliiy*, expressed by the preceding Glyph D, which they respectively translate as "arrived" or "appeared."[9]

The discovery of a lunar table painted on the wall of Structure 10K-2 at Xultun, in the Peten region of Guatemala, brought renewed attention to Maya lunar calculations and the Glyph C variants. The table recorded 162 lunar "semesters," each one associated with one of the three Glyph C deities, which alternated sequentially.[10] In Stuart's reconstruction, the first column of the Xultun table begins with the jaguar god, followed by the death god in the second, and the Maize God in the third column. The three gods likely reappeared in the same sequence across the table. They appear in the same sequence in the *Cylinder Vase with Moon Goddess and Celestial Beings* (from right to left), although the series begins with the Lunar Maize God. But who are these deities, and why did the Maya associate them with the moon?

a b c d e f

4 Chinchilla Mazariegos, *Imágenes*, 205; Marc Zender and Joel Skidmore, "Unearthing the Heavens: Classic Maya Murals and Astronomical Tables at Xultun, Guatemala," *Mesoweb* (website), 2012, 9, www.mesoweb.com/reports/Xultun.pdf.

5 Sylvanus Griswold Morley, *The Inscriptions at Copan* (Washington, D.C.: Carnegie Institution of Washington, 1920), 558.

6 John E. Teeple, "Maya Inscriptions VI: The Lunar Calendar and Its Relationship to Maya History," in *The Decipherment of Ancient Maya Writing*, eds. Stephen Houston, Chinchilla Mazariegos, and David Stuart (Norman, OK: University of Oklahoma Press, 2001), 241–54.

7 J. Eric S. Thompson, *Maya Hieroglyphic Writing: An Introduction*, 3rd ed. (1971; repr., Norman, OK: University of Oklahoma Press, 1985), 241; David Humiston Kelley, *Deciphering the Maya Script* (Austin: University of Texas Press, 1976), 22.

8 John H. Linden, "The Deity Head Variants of Glyph C," in *Eighth Palenque Round Table, 1993*, eds. Martha J. Macri and Jan McHargue (San Francisco: Pre-Columbian Art Research Institute, 1996), 343–56.

9 David Stuart, *The Inscriptions from Temple XIX at Palenque: A Commentary* (San Francisco: Pre-Columbian Art Research Institute, 2005), 64; Zender and Skidmore, "Unearthing the Heavens," 9.

10 William A. Saturno et al., "Ancient Maya Astronomical Tables from Xultun, Guatemala," *Science* 336, no. 6082 (May 11, 2012): 714–17.

The Lunar Maize God

The youthful deity with tonsured head and fancy ornaments hanging from his loincloth, who stands first among the four attendants in the *Cylinder Vase with Moon Goddess and Celestial Beings*, is readily recognizable as the Classic Maya Maize God.[11] Linda Schele and Mary Ellen Miller, as well as Susan Milbrath, recognized portraits of a male moon god in Maya art, although they did not link them with the Maize God.[12] Further research suggests that representations of the Maize God as a lunar deity abound (fig. 5), but scholars often misidentify them as portraits of the Moon Goddess.[13]

A remarkable example appears on the lid of a stone box from the cave of Hunal Ye, which depicts the Lunar Maize God hugging the lunar rabbit (fig. 5c).[14] The image shows only the head and arm (thus excluding gender-related physical attributes or clothing), but the elongation of the head and its infixed maize grain leave little doubt that, rather than the goddess, this represents the Lunar Maize God. The numeral thirty appears in the lunar crescent and in the god's hieroglyphic name, doubtless in reference to a thirty-day moon (which alternated with twenty-nine-day moons in Maya lunar computations). Another portrait, in the Initial Series Introductory Glyph (which typically introduces standard calendric notations) of Stela D at Copan, in present-day Honduras, shows that the Lunar Maize God was the patron of the month Ch'en (fig. 6a). Elsewhere in the inscriptions, his portrait sometimes conveys the syllable *ja* in full-figure hieroglyphs, for instance, in a spelling of the name of the ruler K'ahk Yipyaj Chan K'awiil on the Harvard Bench, from Copan, and in Glyph D of the Lunar Series on Zoomorph B at Quirigua, in southeastern Guatemala—complete with the rabbit (fig. 6b). On the Skyband Bench from Copan Group 8N-11, the Lunar Maize God forms part of a quartet of deities related to the sun (or day), moon, night, and stars (fig. 7).[15] A similar quartet appears on the bracelets and anklets of the earth crocodile portrayed on Quirigua Zoomporph P. The right leg anklet shows a bearded Lunar Maize God with *sak* (white) markings holding the moon sign in his arms. The color links the Lunar Maize God with the north, the direction associated with the moon in the mural paintings of Tomb 12 at Río Azul, Guatemala.[16]

Depictions of the Lunar Maize God sometime pair him with God S, the spotted god of ancient Maya religion. These youthful gods exhibit significant correspondences with the heroes who become the sun and the moon in Mesoamerican narratives. The Maize God was a complex deity with multiple manifestations, but his lunar connotations stand out. Maya artists portrayed him (with or without a lunar sign) performing actions commonly associated with lunar heroes in Mesoamerica, such as dancing, wearing abundant jewelry, and immersing in water in the company of women.[17]

Milbrath highlighted a frequent trait: a downturned mask projecting from his nose.[18] As explained below, this is the snout of the Water-Lily Serpent, often worn as a combined headdress and mask by the Lunar Maize God. While the Moon Goddess wears it on occasion, the Water-Lily Serpent more frequently occurs in portraits of the Lunar Maize God, and their recurrent association may explain the serpent's presence among the attendants on the *Cylinder Vase with Moon Goddess and Celestial Beings*.

11 Karl A. Taube, "The Classic Maya Maize God: A Reappraisal," in *Fifth Palenque Round Table, 1983*, ed. Virginia M. Fields (San Francisco: Pre-Columbian Art Research Institute, 1985), 171–81.

12 Linda Schele and Mary Ellen Miller, *The Blood of Kings: Dynasty and Ritual in Maya Art*, exh. cat. (Fort Worth, TX: Kimbell Art Museum, 1986); Susan Milbrath, *Star Gods of the Maya: Astronomy in Art, Folklore, and Calendars* (Austin: University of Texas Press, 1999), 135–38.

13 Chinchilla Mazariegos, *Art and Myth of the Ancient Maya* (New Haven, CT: Yale University Press, 2017), 202–7; Chinchilla Mazariegos, *Imágenes*, 199–203.

14 Brent K. S. Woodfill, Stanley Guenter, and Mirza Monterroso, "Changing Patterns of Ritual Activity in an Unlooted Cave in Central Guatemala," *Latin American Antiquity* 23, no. 1 (March 2012): 93–119.

15 David Webster et al., "The Skyband Group: Investigation of a Classic Maya Elite Residential Complex at Copán, Honduras," *Journal of Field Archaeology* 25, no. 3 (Autumn 1998): 332.

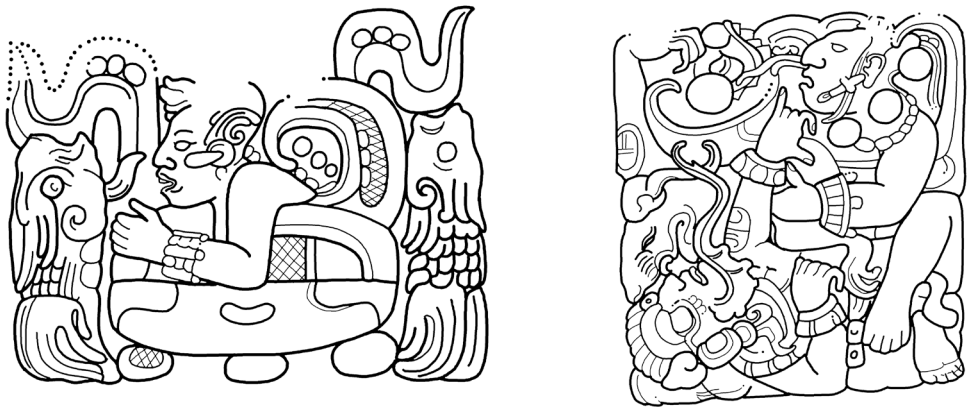
16 Stuart, "The Paintings of Tomb 12, Río Azul," in *Río Azul Reports: Number 3, the 1985 Season = Proyecto Río Azul: Informe tres, 1985*, ed. Richard E. W. Adams (San Antonio: Center for Archaeological Research, University of Texas at San Antonio, 1987), 161–67.

17 Chinchilla Mazariegos, "Cosmos and Warfare on a Classic Maya Vase," *Res.: Anthropology and Aesthetics* 47 (Spring 2005): 107–34; Chinchilla Mazariegos, *Imágenes*, 129–39; Chinchilla Mazariegos, *Art and Myth*, 177, 202.

18 Milbrath, *Star Gods of the Maya*, 137.

5a 5b 5c

Fig. 5
Depictions of the Lunar Maize God: (a) Pearlman Trumpet, Chrysler Museum of Art, Norfolk, Virginia; (b) *Vase of the Stars*, Museo Popol Vuh, Guatemala City; (c) lid of a stone box from the cave of Hunal Ye, Guatemala, with glyphs containing the god's name (shaded)



6a 6b

Fig. 6
Full-figure representations of the Lunar Maize God in hieroglyphic script: (a) patron of the month Ch'en, Stela D, Copan, Honduras; (b) syllable *ja* in Glyph D of the Lunar Series, Zoomorph B, Quirigua, Guatemala

Fig. 7
Carving of the Lunar Maize God and rabbit, Skyband Bench, Group 8N-11, Copan, Honduras

The Water-Lily Serpent

There is no counterpart among the Glyph C gods for the human-bodied Water-Lily Serpent who stands behind the Lunar Maize God. The jawless head with a long, pointed barbel; the thin, downturned snout; the water-lily pad and flower in the head; and a tube-like element projecting above (sometimes resembling an aquatic plant, other times a piece of rolled cloth) constitute distinctive traits of this creature (fig. 8; see also cats. 18, 22, and 23).[19] Stuart suggests a reading for its hieroglyphic name as Juun Witz' Nah Kan.[20] In the hieroglyphic script, the Water-Lily Serpent served as the head variant of the number thirteen, and it also substituted for the HAAB' logogram. Several studies interpret it as symbolizing standing bodies of water.[21] This may explain its association with the Maize God, who frequently appears in aquatic settings in ancient Maya art.

Judging by the number and scale of its representations, the Water-Lily Serpent ranked among the most important deities of the ancient Maya. During the Preclassic period (2500 BCE–250 CE), it often appeared as a collar mask worn under the chin of other characters, sometimes in truly monumental scale—for example, in the preserved lower portions of the colossal stucco masks on the facades of Group H North at Uaxactun, Guatemala, which correspond to collar masks worn by the largely lost deity masks above them.[22] Classic-period facades at Caracol, in Belize, and Dzibilchaltun, in the Mexican state of Yucatan, also displayed monumental stucco renderings of the Water-Lily Serpent.[23] Representations on sculptures and ceramic vessels were frequent, showing the head or the serpent's full body. The Water-Lily Serpent was also worn as a headdress or a combined mask and headdress by rulers depicted at many sites, including Copan (Stela N), as well as Machaquila (Stelae 3, 4, 7, and 8), Ceibal (Stela 11), and La Amelia (Panel 1), all in Guatemala's department of Peten.

Though less frequent, human-bodied portraits of the Water-Lily Serpent span a long temporal range, from the Late Preclassic (350 BCE–150 CE) mural paintings of Las Pinturas Sub-1 at San Bartolo, Guatemala, to the Dresden Codex (thirteenth–fourteenth century; fig. 8b).[24] However, the *Cylinder Vase with Moon Goddess and Celestial Beings* uniquely shows the Water-Lily Serpent with a moon sign. The puzzling lack of other, comparable representations with lunar attributes suggests that the Water-Lily Serpent was not a lunar god per se. But it was a frequent attribute of the Lunar Maize God, and this may explain its presence on the vase. Conceivably, the human-bodied Water-Lily Serpent stood as a personified form of the Lunar Maize God's mask and headdress, standing behind its owner.

19 For more on the iconography and associations of the Water-Lily Serpent, see Nicholas M. Hellmuth, *Monster und Menschen in der Maya-Kunst: Eine Ikonographie der alten Religionen Mexikos und Guatemalas* (Graz, Austria: Akademische Druck- und Verlagsanstalt, 1987), 160–66; Reiko Ishihara, Taube, and Jaime J. Awe, "The Water Lily Serpent Stucco Masks at Caracol, Belize," in *Archaeological Investigations in the Eastern Maya Lowlands: Papers of the 2005 Belize Archaeology Symposium*, eds. John Morris et al. (Belmopan, Belize: Institute of Archaeology, National Institute of Culture and History, 2006), 213–23; and Merle Greene Robertson, "The Celestial God of Number 13," *The PARI Journal* 12, no. 1 (Summer 2011): 1–6.

20 Stuart, "Reading the Water Serpent as WITZ'," *Maya Decipherment: Ideas on Ancient Maya Writing and Iconography* (blog), April 13, 2007, https://decipherment.wordpress.com/2007/04/13/reading-the-water-serpent/; Houston and Stuart, "Of Gods, Glyphs, and Kings: Divinity and Rulership among the Classic Maya," *Antiquity* 70 (June 1996): 299.

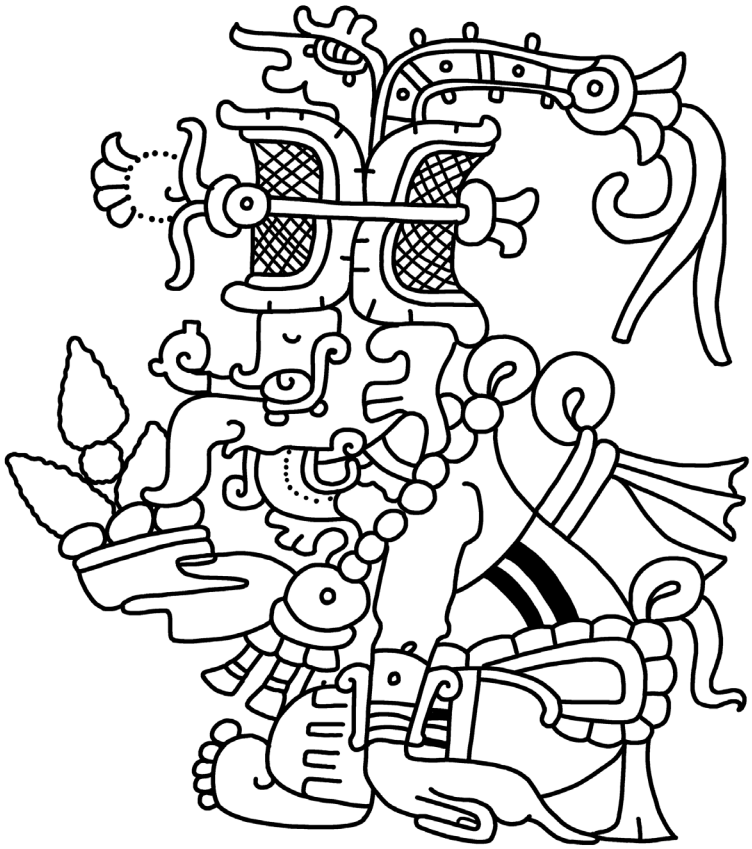
21 Schele and Miller, *Blood of Kings*, 46; Ishihara, Taube, and Awe, "Water Lily Serpent."

22 Milan Kováč, Alice Desprat, and Carlos Pallán Gayol, "New Stucco Masks from Uaxactun: Interpretation, Conservation and Documentation of Extraordinary Preclassic Maya Art," in *Archaeology on Three Continents, 2006–2011*, eds. Drahoslav Hulínek, Dominik Bonatz, and Milan Kováč (Bratislava: Slovak Archaeological and Historical Institute, 2015), 125–42.

23 Ishihara, Taube, and Awe, "Water Lily Serpent."

24 Taube et al., *The Murals of San Bartolo, El Petén, Guatemala, Part 2: The West Wall* (Barnardsville, NC: Boundary End Archaeology Research Center, 2010), 75.

8a



8b

Fig. 8.
Depictions of the Water-Lily Serpent: (a) unprovenienced panel; (b) Dresden Codex, page 13, Sächsische Landesbibliothek, Staats- und Universitätsbibliothek Dresden

The Black-Eyed Jaguar God

The prognathic, human-faced character standing behind the Water-Lily Serpent has two distinguishing features: the rounded ear of a jaguar (painted red and protruding above the ear spool) and a blackened eye socket combined with heavy black lines in the forehead and nose. Jaguar gods are not usually marked with moon signs in Maya art, but a comparable example occurs on vase K9261 (identified using the numbering system assigned by Justin Kerr). This jaguar god with a moon sign appears alongside a young man who may be the Lunar Maize God (not marked with a moon sign but wearing the characteristic Water-Lily Serpent mask). This character likely corresponds to the jaguar variant of Glyph C, which can be written with the profile head of a jaguar god or simply with a jaguar eye characterized by large black spots around the lower side. Early on, Morley recognized that the dark-eye variant of Glyph C corresponded to the name glyph of God M, first identified in 1904 by Paul Schellhas in the codices of the Postclassic period (900–1539 CE).[25] While God M is black in the Madrid Codex, his portraits in the Dresden Codex feature bands of black color or no color at all (fig. 9). A large, pendulous lower lip (a frequent attribute)[26] perhaps corresponds to the prognathous mandible of the black-eyed god of the *Cylinder Vase with Moon Goddess and Celestial Beings*.

Zender and Skidmore suggest connections between the Glyph C jaguar variant and the important deity commonly known as "Jaguar God of the Underworld."[27] Because of the deity's consistent association with warfare, Milbrath's designation as the "Jaguar War God" more aptly describes this important figure related to martial subjects as well as fire, the night, and the stars.[28] Milbrath suggests that he corresponded to the Glyph C jaguar variant, but it should be noted that the Jaguar War God does not bear the heavy black spots around the eye that distinguish the Glyph C deity. Luís Lopes suggests another connection, noting that the dark-eye glyph substitutes for the profile head of the Jaguar War God in several contexts in Classic Maya inscriptions.[29] He tentatively proposed the reading Chuhaaj for the name of the Jaguar War God and linked it with Ekchuah, the name of a merchant god mentioned in Diego de Landa's account of Yucatan—one of the richest sources of information regarding the sixteenth-century Maya.[30] Beginning with Schellhas, scholars have consistently associated that early colonial deity with God M.[31]

It appears that the black-eyed jaguar god of Glyph C was not entirely identical with the Jaguar War God, yet they both bear complex correspondences to God M and other gods with jaguar attributes in the Postclassic codices. The black-eyed jaguar of the *Cylinder Vase with Moon Goddess and Celestial Beings* belongs in this complex group of jaguar deities and likely constitutes a full-figure representation of the Glyph C jaguar god.

The Death God

The most opaque character on the *Cylinder Vase with Moon Goddess and Celestial Beings* is the red-spotted skeleton with flaccid genitals and a fleshed arm who stands at the far left in the rollout photograph. This is likely a full-figure representation of the Glyph C skull variant, but understanding the ways in which he relates to God A and other ancient Maya death gods requires closer examination. Ancient Maya artists portrayed a rather large group of skeletal beings, including *wahy* (companion spirits and disease agents pertaining to powerful men and women) and other deathly figures, such as the skeletal god who throws down the Baby Jaguar on codex-style vessels.[32] None of these characters shows the lunar crescent that marks the skeletal

25 Morley, *Inscriptions at Copan*, 558; Paul Schellhas, *Representations of Deities of the Maya Manuscripts*, 2nd ed., trans. Selma Wesselhoeft and A. M. Parker (Cambridge, MA: Peabody Museum of Archaeology and Ethnology, Harvard University, 1904), 35–37.

26 Schellhas, *Representations of Deities of the Maya Manuscripts*, 35; Taube, *The Major Gods of Ancient Yucatan* (Washington, D.C.: Dumbarton Oaks Research Library and Collection, 1992), 88.

27 Zender and Skidmore, "Unearthing the Heavens."

28 Milbrath, *Star Gods of the Maya*, 124.

29 Luís Lopes, "Some Notes on the Jaguar God of the Underworld" (unpublished manuscript, n.d., copy in possession of author).

30 Diego de Landa, *Relación de las cosas de Yucatán* (c. 1566), ed. Angel María Garibay K. (Mexico City: Editorial Porrúa, 1982), 48, 81.

31 Schellhas, *Representations of Deities of the Maya Manuscripts*, 36; Taube, *The Major Gods of Ancient Yucatan*, 88; J. Eric S. Thompson, *Maya History and Religion*, 3rd ed. (Norman, OK: University of Oklahoma Press, 1970), 306.

32 Nikolai Grube and Werner Nahm, "A Census of Xibalba: A Complete Inventory of Way Characters on Maya Ceramics," in *The Maya Vase Book: A Corpus of Rollout Photographs of Maya Vases*, vol. 4, ed. Justin Kerr (New York: Kerr Associates, 1994), 686–715; Francis Robicsek and Donald M. Hales, *The Maya Book of the Dead: The Ceramic Codex; The Corpus of Codex Style Ceramics of the Late Classic Period* (Charlottesville, VA: University of Virginia Art Museum, 1981), 113–14.

9a

9b

Fig. 9
(A) Depiction of the Postclassic God M holding a bone and (b) his name glyph, Dresden Codex, page 16, Sächsische Landesbibliothek, Staats- und Universitätsbibliothek Dresden

deity of the *Cylinder Vase with Moon Goddess and Celestial Beings*, which remains unique. The male genitals provide a clue about his gender, and he is the only one of the four lunar gods who carries an object in his hand. Despite its enigmatic qualities, this lunar skeletal god shows that some aspects of the moon were associated with death and the gods of death.

The Moon Goddess, the Rabbit, and God L

What was the meaning of the extraordinary reunion of lunar gods depicted on LACMA's vase? Surely, the scene focuses on the submission of the lordly God L, naked and dispossessed, before the pompous rabbit and his mistress, the Moon Goddess. The amusing story of how the rabbit took the regalia of God L is depicted on a number of Classic Maya vessels. According to Dimitri Beliaev and Albert Davletshin, the hieroglyphic passages of the *Regal Rabbit Vase* (K1398 in Kerr's numbering) recount how God L obtained his headdress and how the rabbit stole it after insulting him.[33] As in the *Cylinder Vase with Moon Goddess and Celestial Beings*, the rabbit stands arrogantly above the denuded God L while holding the latter's hat and staff. In the next scene of

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Dmitri Beliaev and Albert Davletshin, "Los sujetos novelísticos y las palabras obscenas: Los mitos, los cuentos y las anécdotas en los textos mayas sobre la cerámica del período clásico," in *Sacred Books, Sacred Languages: Two Thousand Years of Ritual and Religious Maya Literature*, eds. Rogelio Valencia Rivera and Geneviève Le Fort (Markt Schwaben, Germany: Verlag Anton Saurwein, 2006); see Stuart, "Breaking the Code: Rabbit Story," in *Lost Kingdoms of the Maya*, eds. Gene S. Stuart and George E. Stuart (Washington, D.C.: National Geographic Society, 1993).

the *Regal Rabbit Vase*, the rabbit hides behind the enthroned Sun God, who receives God L's complaints and tells him that the rabbit has been captured. Beliaev and Davletshin compared the plot with trickster rabbit tales, widely distributed in modern Maya communities and elsewhere in the New World, in which the rabbit outsmarts and insults larger and stronger animals. In a separate comment, Mary Ellen Miller and Simon Martin highlighted a vase in which several participants seem to throw God L's regalia toward the Moon Goddess and the rabbit, who appear together within a lunar cartouche high above.[34] Noting the presence of the Headband Gods, a pair of youthful personages often adorned with headbands in Classic-period imagery, they suggested links with the sixteenth-century K'iche' myth about the defeat of the underworld gods by the Hero Twins as recounted in the mythic narratives of the *Popol Vuh*.

The variety of representations involving different sets of characters may reflect the artists' preferences, but it also suggests that many variants of the story likely circulated in ancient Maya communities. While the *Regal Rabbit Vase* makes no allusion to the moon, Karl A. Taube noted examples that involve the Moon Goddess (with or without the rabbit) dealing with God L regarding his hat and regalia, and suggested that the episode had cosmic importance.[35] The *Cylinder Vase with Moon Goddess and Celestial Beings* also highlights the participation of the lunar gods who witnessed the rabbit's trickery. Conceivably, the story related to a critical question addressed in Mesoamerican myths: Why is there a rabbit in the moon?

The importance of this question should not be understated. For the sixteenth-century Nahua authors of the Florentine Codex, the explanation of the rabbit in the moon justified their account of the origin of the sun and the moon: "Behold the fable in which it is told how a little rabbit lay across the face of the moon."[36] Indeed, their long and elaborate story culminated when the gods, displeased because the moon initially shone as bright as the sun, threw a rabbit to the face of the moon, dimming its brilliance. This counts among many, often amusing explanations of the lunar rabbit that circulated in Mesoamerica. A modern Chatino version explains that, while the sun and moon heroes (both males) were cutting grass, a startled rabbit jumped and became embossed on the face of the moon.[37] The lunar hero of the Trique simply swallowed a rabbit, which remained inside him.[38] In a Mixtec myth, the hero wanted to take with him several animals, but he dropped them while ascending to the sky, managing to keep only the rabbit.[39] In modern Teenek (Huastec) and Nahua myths from the Gulf Coast, it happened during a mythological flood: A man captured a rabbit that had raised back the trees he had cut down for a *milpa* (a field for planting maize). The rabbit told him that the flood was coming, and jumped on a box in which the man took refuge. When the box rose to the sky with the swelling waters, the rabbit jumped off and stayed on the moon.[40] In another Nahua version, God, angry because the rabbit had warned a peasant about the coming flood, turned the rabbit into a ball and threw him to the sky.[41] Further explanations come from Maya communities in Chiapas, Mexico. According to a Tzeltal narrative, the solar hero captured a rabbit that had raised back the trees in his *milpa* and gave it to his mother, who would become the moon. A Ch'ol version inverts the sequence: The solar hero brought a big white rabbit as a gift for his mother, the moon, but at night, the rabbit raised back the trees. In both iterations, the mother brought the rabbit with her when she and her son rose to the sky, respectively, as the moon and the sun.[42]

The arguments vary, but the outcome remains the same. One way or another, the rabbit became the companion of the lunar god or the lunar goddess. Classic Maya beliefs were more complex; both the Moon Goddess and the Lunar Maize God were

34 Miller and Simon Martin, *Courtly Art of the Ancient Maya*, exh. cat. (San Francisco: Fine Arts Museums of San Francisco; New York: Thames & Hudson, 2004), 59–61.

35 Taube, *The Major Gods of Ancient Yucatan*, 85–88.

36 Bernardino de Sahagún, *Florentine Codex: General History of the Things of New Spain*, book 7, *The Sun, Moon, and Stars, and the Binding of the Years* (1540–85), eds. Arthur J. O. Anderson and Charles E. Dibble (Santa Fe, NM: School of American Research, 1953), 3.

37 Miguel Alberto Bartolomé, *El Ciclo mítico de los gemelos Sol y Luna en las tradiciones de las culturas oaxaqueñas* (Oaxaca, Mexico: Centro de las Culturas Oaxaqueñas, Centro Regional de Oaxaca, Instituto Nacional de Antropología e Historia, 1984), 10.

38 Elena E. de Hollenbach, "El origen del sol y de la luna: Cuatro versiones en el trique de Copala," *Tlalocan* 7 (1977): 143.

39 Samuel Villela Flores and Valentina Glockner, "De gemelos, culebras y tesmósforos: Mitología en La Montaña de Guerrero," in *Creando mundos, entrelazando realidades: Cosmovisiones y mitologías en el México indígena*, eds. Catharine Good Eshelman and Marina Alonso Bolaños (Mexico City: Instituto Nacional de Antropología e Historia, 2015), 247.

40 Anuschka Van 't Hooft and José Cerda Zepeda, *Lo que relatan de antes: Kuentos tének y nahuas de la Huasteca* (Pachuca de Soto, Mexico: Programa de Desarrollo Cultural de la Huasteca, 2003), 91–93, 95–97.

associated with the rabbit. Classic Maya representations suggest that the story of how the little critter outwitted the powerful God L could be told independently, but in some cases they are loaded with lunar connotations. The entire court of the moon deities played a role in the version depicted in the *Cylinder Vase with Moon Goddess and Celestial Beings*. They stand guard before the enthroned goddess just like courtiers before a ruler, but it's unclear whether they are involved in the rabbit's taking of God L's clothes. Regardless of the specific incidents, the vase highlights the lunar connotations of the adventures of the trickster rabbit who took God L's regalia, which conceivably explained why the mischievous bunny ended up in the moon.

41 Minerva Oropeza Escobar, "Mitos cosmogónicos de las culturas indígenas de Veracruz," in *Relatos ocultos en la niebla y el tiempo: Selección de mitos y estudios*, ed. Blas Román Castellón Huerta (Mexico City: Instituto Nacional de Antropología e Historia, 2007), 181.

42 José Antonio Cruz Coutiño, "Integración de secuencias discursivas: El caso de los mitos y leyendas de ascendencia maya en Chiapas (México), vinculadas a la creación del hombre y su entorno" (PhD diss., University of Salamanca, 2008), 416–20, http://hdl.handle.net/10366/22433; M. Esther Hermitte, *Poder sobrenatural y control social en un pueblo maya contemporáneo* (Mexico City: Instituto Indigenista Interamericano, 1970), 24–25.

12 The Trouble with Sets: Renewing the Contexts of Maya Vases

Mary E. Miller

From earliest times, Mesoamerican peoples both made and assembled sets of objects for sacred offerings. Some offerings and tombs explicitly contained heirlooms, revealing the practice of collecting and retaining valued objects to be taken out of circulation at the same moment that a particular human ceased to circulate in the world. Some objects do not show wear, whereas others show not only wear but also active damage patterns incurred at the time of burial or offering. Other objects reveal the wear that comes from a life of use. Many burials and caches contain special sets created specifically for the occasion. For example, four nearly identical companion vessels typically attend the principal urn in tombs at Monte Albán, Mexico, composing a standard set of five items. Offering 48, from the Great Temple in the Aztec capital of Tenochtitlan, in present-day Mexico City, included eleven very similar stone vessels portraying the rain god Tlaloc, each with a matching lid. Although no single, universally practiced approach to interpreting the range of sets encountered archaeologically exists, these larger contextual settings can provide explanatory tools for the analysis of objects located outside such environments, whether encountered archaeologically or in museums of the world.

Yet, generally, researchers investigating the Maya of the first millennium CE concern themselves more with difference than similarity, and sets rarely command significant interest. In Maya studies, innovation holds pride of place, especially the unique work that seems to draw on traditions of Maya art yet to erupt into novelty, such as the *Vase of the Eleven Gods* (cat. 10), subjects of other investigations in this volume. These unique and special objects bear novel information and take an artistic form that achieves expressive heights, suggesting that the artist sought to imbue the greatest complexity through an exceptional solution.

The production of nearly identical work may require equally complex artistic solutions, even if less appealing to the modern observer. Over the course of the first millennium CE, and especially in the southern Maya lowlands, the Maya often made ceramics in sets, but sets in which works resemble one another rather than replicate a single model with precision, either through willfulness or technological limitation. Identical outcomes posed particular challenges for Maya ceramic artists because of the nature of the facture: Vessels were built with coils, then smoothed, and, when necessary, squared. Achieving thin, fine, and consistent walls by this method is not easy, unlike wheel throwing, which allows potters to calibrate one vessel to another based on the size and weight of the clay ball before shaping the pot. Notwithstanding the difficulty of preparing the vessel itself, the work of particular potters can be recognized and aligned with particular painters—suggestive of production in a workshop, in which the potter and painter collaborated or may have been one and the same person (see cat. 18). Under the conditions of the workshop, in which materials were likely shared, sets may have developed organically, but the explicit depositing of sets within Maya burials argues for intentionality.[1] The workshop also would have lent itself to the development of the "compressed" and closed series, in which the production of related works took place, perhaps collaboratively, in a short period of time and for a particular purpose, or as what effectively constitutes a commission. Nevertheless, regardless of the production circumstances of related works, achieving the outcome of nearly identical ceramic vessels without recourse to a mold required intensive control on the part of the maker.

Although rarely discussed, sets and series abound in Maya art. At Tikal, in present-day Guatemala, Stelae 19, 21, and 23 can be thought of as a series, separated by the dates of their carving and erection but visually so similar that they may well

1 Dorie Reents-Budet et al., *Painting the Maya Universe: Royal Ceramics of the Classic Period*, exh. cat. (Durham, NC: Duke University Press in association with Duke University Museum of Art, 1994), 61–65.

have seemed identical to anyone who had the opportunity to see them, especially given their distance from one another at the site. H. J. Spinden and T. Proskouriakoff addressed the separate series of monuments at Piedras Negras, Guatemala, yielding new readings of Maya art (whereas Sylvanus Griswold Morley noted these series only for the calendrical character); the narrative of any individual series at Piedras Negras could be amplified over time, allowing for change within the context of repetition and identity.[2] The large wooden figures of the god K'awiil from Tikal, four in number and painted with brilliant Maya-blue paint, formed a set intended to be nearly identical and seen together, deposited as they were in Burial 195. Sets occur frequently in Maya figurines; the examples of the figurines from El Perú-Waka', Guatemala, show that nearly identical sets could nest within other sets for assembly in an offering.[3] Yet even when using a mold to standardize outcomes, the Maya maker sought to distinguish the final product through both paint and final details, as evidenced by a comparison of nine figurines from different Maya burials on Jaina Island, Mexico. Six appear to have been made in a single mold, and three in a very similar one; they may or may not have ever existed as a set.[4] The making of sets presents not only a fully different range of challenges to the artist but also a distinct way to practice and learn for the apprentice. Additionally, because of ancient distribution practices and modern looting, sets can straddle both archaeologically excavated and looted works, and when one item in a demonstrable set is found in a location distant from the place of origin, the modern observer usually imagines gift giving .[5]

LACMA's collection of Maya ceramics includes obvious sets and individual vessels that likely once belonged to a set. Whereas most of the essays in this volume address the unique object, imbued with complex meaning and often bearing rich textual material for further interpretation, this investigation looks at the practice and meanings of sets, with particular attention to the meaning that may be conferred upon the individual museum object. Most of the objects come from burial offerings, which encompassed extensive and often repetitious sets along with unique objects: Many also would have stood out as unusual in their archaeological context, such as the so-called Bonampak vessel of Tikal Burial 116, noted for decoration that resembles both style and subject of Bonampak, 300 kilometers to the southwest.[6]

For thorough understanding, the study of sets in context should start at Tikal, where the many sets of Maya vases—along with unique vessels spotted among them—have received study relating to archaeology, paste, and iconography.[7] Two tombs—one of the ruler Jasaw Chan K'awiil (d. 734 CE) in Burial 116, and the other of an unidentified member of the royal family (d. mid-eighth century) in Burial 196—have provided detailed materials for study, with sets that closely relate to one another (fig. 1). When Nicholas M. Hellmuth excavated Burial 196 in 1965, he recognized the relationship to Burial 116, which had been excavated a few years earlier. In both tombs, extensive sets of offerings were laid out in the alley along the raised funerary bench, visible in the tomb plans.[8] His descriptions of the abundant contents of vessels, by then reduced to nothing more than piles of decomposed organic materials, much of it little more than dust, speak to the great quantity of perishable offerings that scholars might never identify. Burial 196 contained a set of ten cylinders, notable mostly for their number, shape, and clearly shared sloppy facture, which exhibited copying among them and erratic execution.[9]

Clemency Chase Coggins, in her 1975 dissertation, raised the possibility that the Burial 196 cylinders resulted from a collective effort, perhaps made by a funerary gathering that became increasingly inebriated as the project progressed.[10] They are

2
H. J. Spinden 1913, T. Proskouriakoff 1950, and Sylvanus Griswold Morley 1937–38 as cited in Megan E. O'Neil, *Engaging Ancient Maya Sculpture at Piedras Negras, Guatemala* (Norman, OK: University of Oklahoma Press, 2012), 112–16.

3
D. Freidel, M. Rich, and F. K. Reilly III, "Resurrecting the Maize King: Figurines from a Maya Tomb Bring a Royal Funeral to Life," *Archaeology* 63, no. 5 (September/October 2010): 42–45.

4
Mary E. Miller, "Molding Maya Practice: Standardization and Innovation in the Making of Jaina Figurines," *RES: Anthropology and Aesthetics 71/72* (Spring/Autumn 2019).

5
Reents-Budet et al., *Painting the Maya Universe*, chap. 7.

6
Clemency Chase Coggins, "Painting and Drawing Styles at Tikal: An Historical and Iconographic Reconstruction" (PhD diss., Harvard University, 1975); T. Patrick Culbert, *The Ceramics of Tikal: Vessels from the Burials, Caches, and Problematical Deposits* (Philadelphia: University Museum, University of Pennsylvania, 1993), first drew attention to the similarities between the vessel and the Bonampak paintings, 507.

7
Coggins, "Painting and Drawing Styles at Tikal"; Culbert, *The Ceramics of Tikal.*

8
Nicholas M. Hellmuth, "Structure 5D-73, Burial 196, Tikal, Peten, Guatemala: A Preliminary Report" (BA thesis, Harvard University, 1967).

9
Culbert, *The Ceramics of Tikal*, figs. 86–91; Miller and O'Neil, *Maya Art and Architecture*, 2nd ed. (London: Thames & Hudson, 2014), 193.

10
Coggins, "Painting and Drawing Styles at Tikal," 562–66.

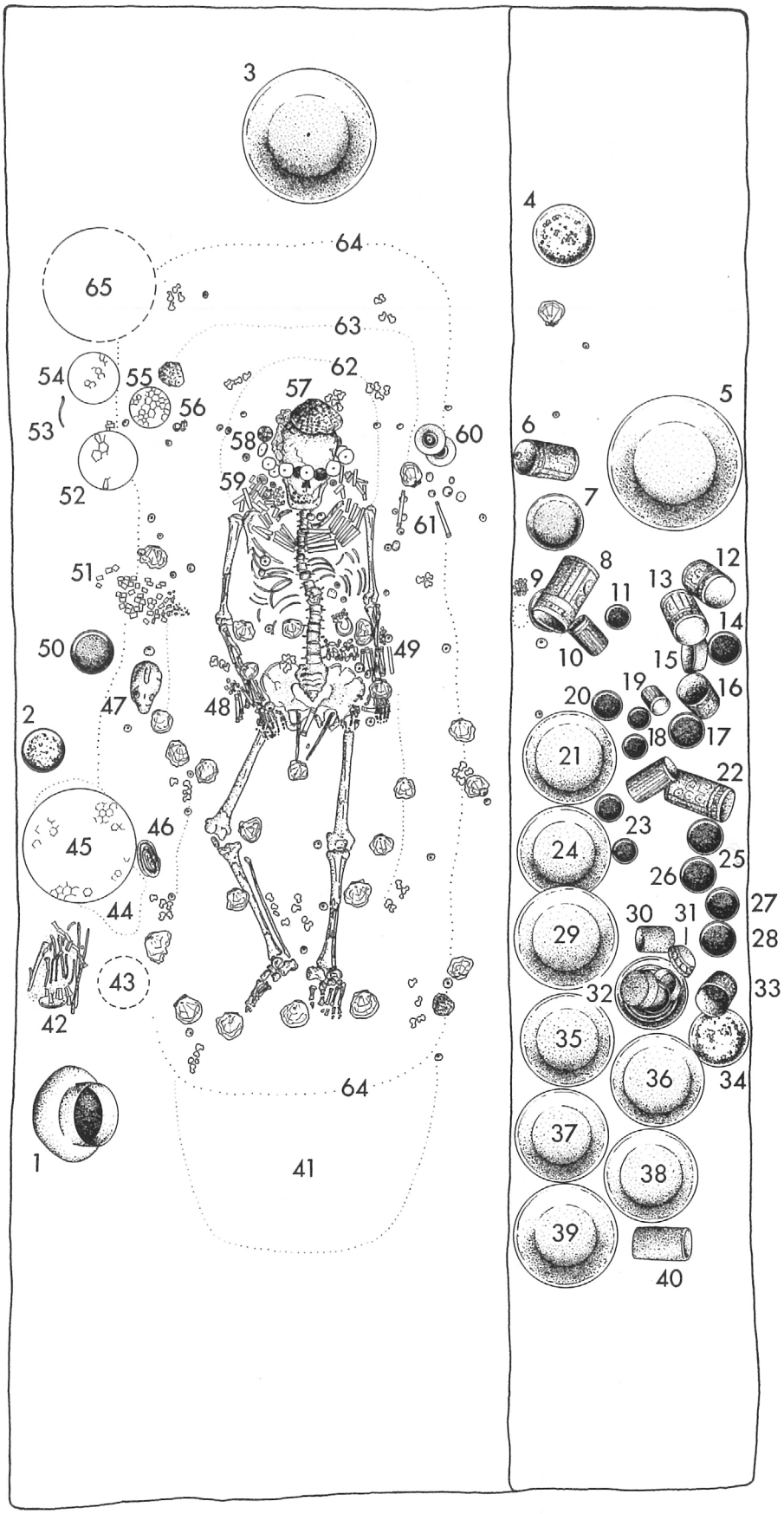

Fig. 1
Plan of Burial 196, Tikal, Guatemala (courtesy of the Penn Museum, Tikal Project image no. 67-5-18, plate 94, Culbert 1993)

certainly a disturbing set. As T. Patrick Culbert noted, they feature sloppily applied pigments and casually executed firing.[11] The makers of these ten vessels also applied slips before carving them at the leather-hard stage. Clay slips of different colors had to be kept completely separate so that a heavy and wide brush could pick up the two principal colors, one mustard and the other dark brown, with little blending or mixing taking place; the deliberately streaky result sought to convey the idea of wood grain, as if each of these vessels were hollowed out of a tree branch. Here, the technique of carving also aligned with the referent wood along every dimension.[12] Almost identical in size, the ten vessels might be thought of as a thick branch of a tree, lopped off as logs.

A single vessel stands out as the most complex and competent of the set in its clear rendering of a deity head and its determination to suggest hieroglyphs (even though rendered as pseudo-glyphs) rimming the vase. The other vessels of the series all address the first one, so it might seem, although one can read them as increasingly degraded references that diminish in quality one step after another. The line warps from deity eye to simple round squib, from proportions that aligned with those of the cylinder vessel to distortions that further dissolve the composition by no longer being visible from a single vantage point. Working on leather-hard ceramics, and especially carving on the clay where the thick background has been removed, required great skill—and the very skill level of the outcomes may suggest makers unfamiliar with the practice. Yet the distorted stylistic outcome may speak to willful variations on the part of some makers, not chance or accident. Following the preparation, the vessels likely would have been fired in an open pit and, perhaps, if made both *at* and *for* the funeral, under pressure of time.

A set of eleven cylinders in the related Burial 116 might also seem to suggest similar facture. Here, however, conventional, single-process slip painting finished the vessels. The two best-painted examples suggest a model in another medium, perhaps painted on paper.[13] The backgrounds were painted first, using a strong contour line to make subsequent errors less likely; the strong red background suggests the deep red walls of Maya architecture and an occasional swag curtain that invites the viewer. That these two burials shared such extensive sets, unknown in any other excavated context, underscores other shared practices and offerings in both tombs. At LACMA, M.2010.115.924.1 and M.2010.115.924.2 may once have formed part of a much larger set like these Tikal examples and, with their slurried slip pattern, probably originated in the central Peten region of Guatemala.

Although many sets have been looted and dispersed, some fit together like a cup and saucer, as M.2010.115.7 goes with M.2010.115.6, both in LACMA's collection (also see cats. 3 and 4 and 12 and 13).[14] Surely, many more Maya vessels without either archaeological or epigraphic evidence as to their origin once belonged to sets that continue to resist identification. Most vessels made in the wood-imitation style characteristic of Tikal Burial 196 probably belonged to a set, including M.2010.115.257 (K5060 in the numbering assigned by Justin Kerr; K numbers will be used for vessels posted on www.mayavase.com and not part of LACMA collections).[15] This vessel, characterized by a slip finish that suggests wood and the low-relief carving that wood requires, depicts a lidded vessel behind one of the seated maize deities. K109 may be that very lidded vessel depicted on the LACMA example; it too is characterized by wood-streaked slip. Although executed by a different artist, K8552 bears dimensions similar to the LACMA vessel and with the same streaky slip; with closely related imagery, the two vessels almost certainly belong to a single set. The skill of the artist who carved K8552 exceeded that of the LACMA maker, as demonstrated in

11 Culbert, *The Ceramics of Tikal*, fig. 86; the illustrations do not capture the nature of the paint.

12 Stephen Houston, *The Life Within: Classic Maya and the Matter of Permanence* (New Haven, CT: Yale University Press, 2014).

13 Culbert, *The Ceramics of Tikal*, fig. 69; again, the archaeological illustration does not capture the painting effectively.

14 Reents-Budet et al., *Painting the Maya Universe*, 324; see also John W. Hirx and O'Neil, "Building the Ceramic Vessel" and Manufacturing Techniques, in this volume.

15 Justin Kerr, *The Maya Vase Book: A Corpus of Rollout Photographs of Maya Vases*, 6 vols. (New York: Kerr Associates, 1989–2000).

the execution of hands, ears, and eyes. Although now only visible as faint traces, the same blue bands that decorate the LACMA vessel once also adorned K8552.

As John W. Hirx and Megan E. O'Neil have noted in this volume, X-ray analysis at LACMA of cat. 17 has revealed its unusual potting (XRF TK, fig. 6).[16] All coils meet at a single join point, aligning behind the painted vertical of one of the pillars that supports the thatch trim of a supernatural palace, in which luxurious cacao is delivered to God L. An X-ray of its partner, a vessel likely painted by the same hand in the collection of the Museum aan de Stroom, in Antwerp, might well reveal similar potting, as might a related vessel excavated from the Actun Balam Cave of Belize, part of the national collection of Belize.[17] All three feature a distinctive rim treatment with a raised band near the lip. The base of the Actun Balam example was missing when the fragments were recovered from the cave, making it possible that the distinctive three rounded feet of the other two vessels may once have supported the Actun Balam pot as well. Such explicit details of facture identify workshops: One artisan executed multiple vessels and developed shared conceptions of space in the Maya palace. Despite its subject—hunting—the Actun Balam scene takes place on palace steps, like the LACMA and Antwerp examples. The archaeological context of the Actun Balam vessel—that is to say, in a cave, and probably ritually broken—suggests that these vessels were separated from one another during the first millennium CE.[18]

Plates rank among the sets that have consistently earned little attention from investigators, perhaps because they tend to have the briefest texts, if they bear texts at all, and because many were ritually killed, the resulting damage of which has limited aesthetic interest. Many plates held maize offerings in tombs as they did in life, as seen on cat. 6. Excavated examples of plates at Uaxactun, Guatemala, first made clear that the dancing Maize God himself, a whirling performer akin to the slender, lanky maize plant, adorns the interiors of such vessels, the subject aligned with the container's meaning.[19]

Plates featuring the Maize God are programmed for the feast in life or death and commonly appear in sets: K5358, K5375, K5379, and possibly K5603 exhibit almost identical dimensions and suggest a similar hand. Although from a different set, LACMA M.2010.115.457 and M.2010.115.456 were surely painted by a single artist and originated in the same workshop. That both sets bear numbers in sequence at Kerr's photographic studio makes it likely that one dealer sold them, acquiring them from a single source in Guatemala.

At Tikal, sets of vessels clogged the alleyway that ran alongside the raised bench for the interred in Burials 116 and 196. The sets were probably the final deposits, and one can even imagine that they were offered in sequence, with each donor perhaps backing out of the tomb after placing an offering in the alley. In Burial 196, nine plates, with a tenth on the bench, bear the painted design nicknamed "dress shirt" in the 1930s by Robert Smith; he found this pattern, particularly common at Uaxactun, both in tomb offerings and in ceramic discards.[20] Burial 196 contained the single largest known deposit of these vessels (fig. 2).

Coggins drew attention to the format of the Burial 196 plates, the "dress shirt" designs, their restricted palette, and the fact that many of them had elaborate feet; such feet kept the proffered foodstuffs farther from the ground and made it easier for a supplicant to handle a vessel that could have held hot tamales. While uniformly large and heavy, the one on the bench, and thus the first offered, is the largest and heaviest of all. Coggins identified the pattern of the plate as that of *muwan* (*Megascops guatemalae,* the screech owl common to Maya forests) feathers, not the silly banker's

16 See John W. Hirx and Megan E. O'Neil, "Building the Ceramic Vessel," in this volume.

17 David M. Pendergast, "The Actun Balam Vase," *Archaeology* 19, no. 3 (June 1966): 154–61.

18 See Dorie Reents-Budet and Ronald L. Bishop, "Pottery of the Central and Eastern Peten: A Study of Chemistry and Style," in this volume.

19 Robert E. Smith, *Ceramic Sequence at Uaxactun, Guatemala* (New Orleans: Middle American Research Institute, Tulane University, 1955), frontispiece.

20 Ibid.

Fig. 2
Drawings of two muwan-feather plates from Burial 196, Tikal, Guatemala (courtesy of the Penn Museum, Tikal Project image nos. 67-5-18, 67-5-20, 67-5-23, plate 94, Culbert 1993)

Fig. 3
Drawing of K1560

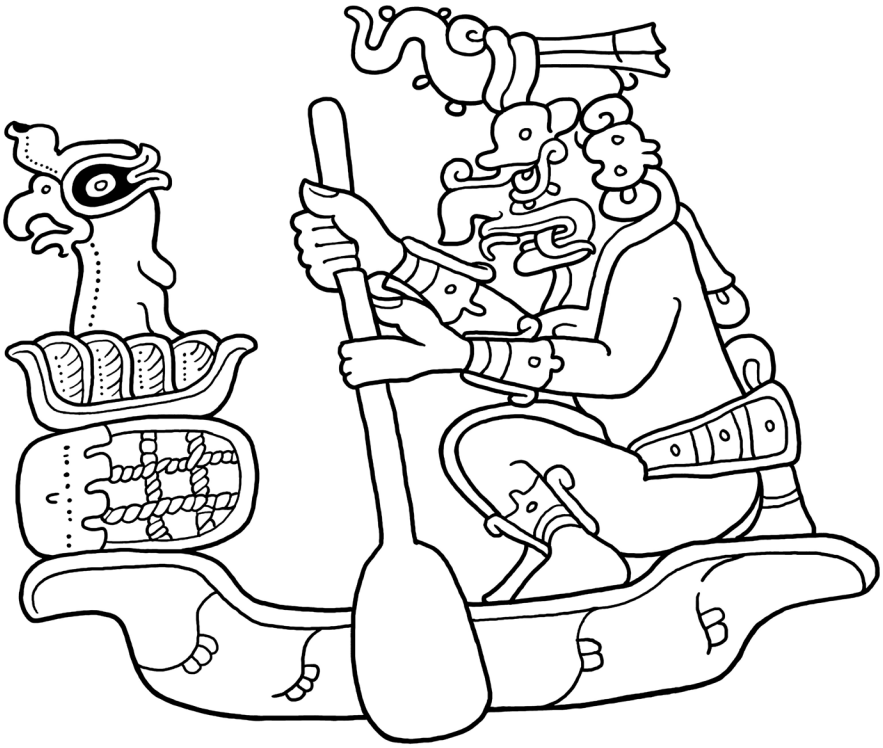

Fig. 4
Page 43c of the Dresden Codex

tie-and-shirt nickname, and she went on to propose that this was in fact the hat of an aged deity, although she did not name God L—yet, obviously, he is the referent she had in mind.[21]

And there Coggins left the subject. Arlen F. Chase picked it up later, noting that depictions of such plates appeared on two vessels he excavated at Tayasal, Guatemala.[22] Chase too thought of it as just a design. The plate depicted at Tayasal, heaped with tamales, recalls the actual Tikal Burial 196 examples reported by Hellmuth. K1560, as drawn by Karl A. Taube, identifies this design as God L's hat, held up by the Maize God's attendant dwarf (fig. 3). Taube also showed that Chahk, the Maya rain god, takes God L's bundle of trade goods and his hat on page 43c of the sixteenth-century Dresden Codex; in this instance the hat appears upside-down, a clear visual analogue to the painted ceramic vessel (fig. 4).[23] The hat thus turns into a plate, and the plate bears the meaning of the hat. As argued elsewhere, the meaning of this hat can now be understood in its role in the life and humiliation of God L and his adversarial relationship to the Maize God: God L's purloined hat becomes the offering vehicle to the Maize God, attesting to God L's eternal submission in the tomb.[24] In this way, the ten large examples of this plate in Burial 196 depict God L's hat turned upside-down and filled with bounty. This is the mythic moment of the narrative fulfilled: The symbolic "hat" has now been delivered ten times over, piled high with offerings to the dead lord, who in turn wears the heavy jade adornments of the Maize God, awaiting rebirth.

The design of other sets of plates also may have prompted an interactive narrative of God L and the Maize God. An unusual squared and footed plate excavated in Burial 30 at Dos Pilas, Guatemala—a gift from the lord of the Ik' site[25]—features the black-and-white feathers of God L's hat on the exterior and a full polychrome K'awiil (often the Maize God's ally and the bearer of sacks of maize kernels necessary for renewal)[26] on the interior, perhaps in emulation of the dimorphic style characteristic of squared cylinder vessels (see cat. 10). LACMA vessel M.2010.115.535, also squared but without text, may once have been this vessel's mate. Painted on the exterior with a wraparound jaguar pelt of the Maize God's throne, the vessel shows the bejeweled, victorious Maize God himself in its interior. When made, the paired vessels would have presented the Maize God triumphant on one and the hat of God L underneath K'awiil on the other, as if in service to the deity.

In other instances, complex narrative content may not have required a set, as, for example, when a Maya painter layered meaning upon meaning in a single vessel. With its hybrid imagery of jaguar pelt and feathers deployed across its interior, M.2010.115.99 may conflate the narrative of God L and the Maize God into an abstract and thus nearly unrecognizable design. M.2010.115.843 may make the reference in a different format: The interior suggests a jeweled maize kernel image. The upper band of the exterior relates a historical narrative of the birth, presumably in the year 688 CE, of K'ahk' Tiliw Chan Chaak, a ruler of Naranjo, a city east of Tikal. Elegant waterbirds serve as spacers for repeated 4 Ajaw glyphs, which indicate the date. Hidden from view until held in the hands, the underside presents the stylized design of God L's hat. In short, the hat of God L sits under maize once again.

From the eighth century onward, surviving sets and individual plates refer repeatedly to God L and the Maize God, sometimes through visual references that may seem cryptic to the viewer today but were surely obvious to the ancient Maya who made them. The great number of such plates in Tikal Burial 196 still may serve as the most instructive example, because sets of hastily made low-quality cylinders were

21 Coggins, "Painting and Drawing Styles at Tikal," 409–10.

22 Arlen F. Chase, "Contextual Implications of Pictorial Vases from Tayasal, Petén," in *Fourth Palenque Round Table, 1980*, eds. Merle Greene Robertson and Elizabeth P. Benson (San Francisco: Pre-Columbian Art Research Institute, 1985), 193–201.

23 Karl A. Taube, *The Major Gods of Ancient Yucatan* (Washington, D.C.: Dumbarton Oaks Research Library and Collection, 1992).

24 Miller, "El rol del Dios L en los entierros de los reinos del Siglo VIII en Tikal," in *Segunda Mesa Redonda del Mayab*, ed. Alfredo Barrera Rubio (forthcoming).

25 Markus Eberl, "Community Heterogeneity and Integration: The Maya Sites of Nacimiento, Dos Ceibas, and Cerro de Cheyo (El Peten, Guatemala) during the Late Classic" (PhD diss. Tulane University, 2001), 100–101.

26 See Miller and Simon Martin, *Courtly Art of the Ancient Maya*, exh. cat. (San Francisco: Fine Arts Museums of San Francisco; New York: Thames & Hudson, 2004); Martin, "Cacao in Ancient Maya Religion: First Fruit of the Maize Tree and Other Tales from the Underworld," in *Chocolate in Meosamerica: A Cultural History of Cacao*, ed. Cameron L. McNeil (Gainesville, FL: University Press of Florida, 2006), 154–83.

offered alongside the set of ceramic "hats" in the alley of this Maya tomb. Who made such offerings? And what was their social value? Might the poor-quality paste and the hasty firing speak to a disregard for permanence in the tomb—or possibly for the deceased on the part of those who made the offering? Was there special meaning in the simplicity of the hat-plate format and the attendant absence of figuration? These sets would seem to constitute separate offerings made by particular cohorts of donors at the time of the lord's death, two distinctive groups sponsoring two sets of ten vessels. Would this format, especially stripped of the human figure, survive into later Mesoamerican imagery? Eventually, research will likely reveal more about the Maya and cohorts of professional traders—perhaps like the later Aztec *pochteca* merchants of Central Mexico. Groups of traders might have strategically abased themselves by making "hat" offerings to Maya kings. The hat plate might also form the basis for the later Mexica *cuauhxicalli* (literally, "eagle gourd vessel") that held human hearts for offerings to the sun. These vessels, usually carved of stone with eagle feathers rendered within, form a continuous round that resembles the Maya feather plates. For now, evidence clearly indicates that the mythological narrative of God L and his purloined hat enhanced possibilities of divine rebirth for elite Maya lords.

At their most elaborate, a Maya king or queen's funeral offerings included extensive sets that may have held foodstuffs for the afterlife as well as special gifts acquired in life. Vessels with ancient mends show that the Maya treasured some vessels even when they could no longer fulfill their function as secure containers. Other objects were terminated. Once sealed within a burial chamber, the works could not be seen, but any performance associated with them may have gained value in memory, amplified by their very invisibility. A set of ten plates in the form of God L's hat would have presumably been offered by ten individuals, perhaps traders who also deposited the finely woven clothing of God L: Imagine the performance of ten individuals entering the tomb richly attired and bearing heavily laden plates, only to step out of the chamber nearly naked.

The Tikal excavations continue to provide documentation that can make it possible to perceive a narrative, even for vessels that have seemed, in their abstraction, to preclude such an interpretation. Most museum collections, LACMA's included, have been built by collectors rather than archaeologists, with the seemingly unique object taking pride of place over workshop-driven sets of nearly identical vessels. But the vessels assembled by LACMA can be connected to collections far and wide, some archaeological, revealing stories distinct from those of the single, cherished, and seemingly idiosyncratic vessel. These sets provide a window onto social practice and social belief and, in the case of the Maya plate, show how the scripted preparations for death and burial performed the central mystery at the heart of Maya religion through Maya ceramics. LACMA's comprehensive collection and, now, its study of Maya vessels allow this story to unfold more fully, establishing both a twenty-first-century context for, and the original meaning of, works that might otherwise have little to contribute to the interpretation of ancient Maya culture.

13 The Social Life of Maya Pots

Stephen Houston

Every object made by humans obeys social needs. Someone created it after learning from others about how that should be done, as well as what the finished product should look like and how it should be used. The Maya ceramics at the Los Angeles County Museum of Art (LACMA) can tempt viewers to stand back and marvel at their aesthetic merits. But the *necessity* for contemporary observers is to probe the broader motivation of these works, to ask why such expressive investments were made and how those ceramics operated in the royal courts that guided their production.

Some of the answers seem obvious: The ceramics held food and liquid for serving, and to reach down to pluck a tamale exposed a painted surface. Raising a pot for drinking or frothing brought the eyes into close contact with glyphic texts and images. Indeed, the verb on many of them focuses on elevating a vase, perhaps in a toast or offering. A few bowls and cylinder vases were so large that, in their bulk, they could seem like furniture; others, especially cups with concave outlines, offered a more intimate experience. The kinetics or physical acts of grasping these objects remain poorly understood. How did weight, balance, and physical tractability change with a liter or more of drink in a bowl or a plate full of tamales, a steamed maize bread? Some bowls or vases would require two hands to hold. How the ancient Maya established container size requires further research. Volume and measures might have varied in systematic, detectible ways, not, perhaps, established by law but by custom or quantity of serving for a specified number of guests. Beyond mere practicality, the metaphors for ceramics can become equally hard to fathom. Microcosm blurs with macrocosm, the small with the large: Scale and monumentality take on new meaning. For example, plates could be understood and labeled as "dwellings" (*otot*) for food or in relation to more opaque phrases.[1] One dish bears, in Classic Mayan, a phrase reading "*u-k'inil, u-cha'nil*," possibly a reference to diversions or public celebrations involving time or days (*k'inil*) and festivals (*cha'nil*).[2] Several vases were certainly regarded as house models, especially the box-like vessels that might have supported covers or "roofs" (e.g., cats. 10–11). Other dishes encompassed an entire cosmos. Maya potters could condense the whole world, from watery underworld to empyreal heights, into a piece of worked, painted, and fired clay.[3]

By now, because of glyphic labels, it is commonly accepted that most of the cylindrical ceramics held chocolate, and a few, a generous ration of *atole* (maize dough mixed with water). Yet, despite often clear spellings in glyphs, which record precise sounds, the meaning of other flavorings continues to resist interpretation.[4] That the ancient Maya might have appropriated a labeled pot for some unintended purpose, as reflected in vestigial chemicals of this or that food, is less than surprising: Which coffee mug today could not also serve for tea, milk, or a dram of whiskey? Given the human nature to improvise, discrepancies on Maya pots between chemical studies and stated contents seem less puzzling than one might think.[5] Several bowls might even have found secondary uses housing water for washing (*pokol*) the brushes or quills (*chehb*) of calligraphers or cupping decoctions of chile (*'ichil*) or bean gruel (*'ibil*).[6] A flat-bottomed bowl claims, against expectation, to have served for drinking chocolate. Did a painter unthinkingly transfer a textual formula to the wrong ceramic? Some containers held truly unpleasant contents. In one image, vomit streams into a bowl out of the mouth of a scribal monkey attended by a goddess of healing.[7] A comely woman, perhaps his consort, strokes and soothes his temples and neck. Similarly, in a scene of a mythical birth, a house-model vase in the LACMA collection (cat. 11) shows a bowl with leg supports. Inside lie a bloody blade and possibly the placenta ejected from a goddess's womb; nearby, elderly, jaguar-like

1 For an example in LACMA's collections, see M.2010.115.5.

2 Stephen D. Houston, "Classic Maya Depictions of the Built Environment," in *Function and Meaning in Classic Maya Architecture: A Symposium at Dumbarton Oaks, 7th and 8th October 1994*, ed. Houston (Washington, D.C.: Dumbarton Oaks Research Library and Collection, 1998), 349, fig. 13; Alexandre Tokovinine, "A Classic Maya Term for Public Performance," *Mesoweb* (website), 2003, http://www.mesoweb.com/features/tokovinine/performance.pdf.

3 James Doyle and Houston, "The Universe in a Maya Plate," *Maya Decipherment: Ideas on Ancient Maya Writing and Iconography* (blog), March 4, 2017, https://decipherment.wordpress.com/2017/03/04/the-universe-in-a-maya-plate/.

4 Dmitri Beliaev, Albert Davletshin, and Tokovinine, "Sweet Cacao and Sour Atole: Mixed Drinks on Classic Maya Ceramic Vases," in *Pre-Columbian Foodways: Interdisciplinary Approaches to Food, Culture, and Markets in Ancient Mesoamerica*, eds. John Edward Staller and Michael Carrasco (New York: Springer, 2010), 257–73.

5 Jennifer Ann Loughmiller-Newman, "The Analytic Reconciliation of Classic Mayan Elite Pottery: Squaring Pottery Function with Form, Adornment, and Residual Contents" (PhD diss., State University of New York at Albany, 2012).

Fig. 1
Detail of *Squared Vase with Supernatural Birth Scenes*, "The Birth Vase," (cat. 11) LACMA, M.2010.115.452

6
Erik Boot, "Classic Maya Vessel Classification: Rare Vessel Type Collections Containing the Noun *Cheb* 'Quill,'" *Estudios de historia social y económica de América*, no. 15 (1997): 65–66; David Stuart, "Chili Vessels," *Maya Decipherment: Ideas on Ancient Maya Writing and Iconography* (blog), March 24, 2016, https://decipherment.wordpress.com/2016/03/24/chili-vessels/; Christian M. Prager, "The Term 'Lima-Bean Vessel' in the Classic Mayan Lexicon," *Textdatenbank und Wörterbuch des Klassischen Maya*, Research Note 11 (December 10, 2018), https://doi.org/10.20376/IDIOM-23665556.18.rn011.en.

7
Vomit scene: K6020, in the Justin Kerr labeling of Maya vases.

midwives work expertly at their craft.[8] Painted a lurid red, the sides of the depicted bowl display the sign for a highly polished surface, perhaps an indication of bright burnishing or a clue that it was made from some material other than clay (fig. 1). In their original context, the ceramics in the LACMA holdings existed alongside wooden objects of similar shape. Several pots in Maya paintings and carvings bear a *te'* (wood) sign to underscore their non-fired substance. This lost world of perishables included other long-decomposed receptacles of gourd, wicker (lined with wax, possibly for waterproofing), leather, and even armadillo shell. Ingenious Maya potters and painters mimicked all of these in clay.[9] Across the board, craftspeople took special pleasure in evoking one material through another.

Generally, in images, low quantities of ceramics or vessels occur in any one place at one time. The premise that feasting was the main focus of finely painted ceramics is belied by wide visual evidence that consumption appears mostly as a royal prerogative: The ruler ate or received offers of food and drink—sharing fails to register as an apparent aim or impulse. Generosity or reciprocity doubtless took place, but they were not deemed important enough to display, other than in almost orgiastic gatherings of old gods and their far younger concubines. Decorous dining constitutes a principal theme, yet some images highlight its very opposite: young men whirling in drunken abandon after drinking pulque, a drink prepared by macerating and fermenting the leaves of the agave plant.[10] Painters sometimes embellished depictions of ollas, or water-storage ceramics, with the sign for agave, *chih*—the Maya delighted in overt mergers of text and image—or with markings for honey to denote mead. Few of those ceramics made their way into present-day collections of art, but they contributed as much as a chocolate pot to joyous and pleasing meals or parties.

Despite all the clues that pots could pass through political networks, they tended to record a single owner. A very few referred to several people, their names appearing in multiple rows.[11] But these pots appear only during the early years of the Late Classic period (600–800 CE) and must have been intended for special settings. Some stripped-down, spare tags of possession offer no more than a sequence of generic titles used by many. Or, in more elaborate and distinctive phrases, they may note a particular person, listing personal names, titles of rule, and, far more rarely, a reference to the painter who created the text and its accompanying image. In much of the past, regardless of time or place, writing conveyed a degree of orality. Silent reading ran contrary to common practice. Accordingly, on Maya ceramics, scribes identified texts as having been "said" (*cheheen*), as though little distinguished written word from utterance. All such works profoundly accentuate the gendering of ownership. Men owned pots, while those possessed by females, royal ones at that, can be counted on one hand. Ceramics without such statements may have circulated more broadly, free from an awkward notation that attributed ownership, perpetually so, to someone else. (Imagine drinking from a mug emblazoned with someone's else name.) Gendering may have inflected production too: If only men painted pots, as a few texts suggest, women might have modeled the ceramic forms, giving pots, rather like humans, a hint of mixed production. In both cases, a man and a woman collaborated to create something new.

The most striking owners were not adults but so-called *ch'ok* (literally, "sprouts," after a decipherment by David Stuart), boys or young men under twenty years of age.[12] Many glyphs further specify them as *chak ch'ok*, probably "great youths," which may reference young men on the verge of adulthood (fig. 2). Attempts to estimate the number of vessels belonging to such figures encounter

8 Karl A. Taube, "The Birth Vase: Natal Imagery in Ancient Maya Myth and Ritual," in *The Maya Vase Book: A Corpus of Rollout Photographs of Maya Vases*, vol. 4, eds. Barbara Kerr and Justin Kerr (New York: Kerr Associates, 1994), 652–85.

9 Houston, *The Life Within: Classic Maya and the Matter of Permanence* (New Haven, CT: Yale University Press, 2014), 32–44.

10 Houston, Stuart, and Taube, *The Memory of Bones: Body, Being, and Experience among the Classic Maya* (Austin: University of Texas Press, 2006), 118–30.

11 Tandem ownership: K5452, in the Justin Kerr labeling of Maya vases.

12 Houston, *The Gifted Passage: Young Men in Classic Maya Art and Text* (New Haven, CT: Yale University Press, 2018), 67–82.

difficulties because of what archaeologists call "sampling issues"—the ceramics available for examination include only those unearthed through excavation or looting, not the full total that ever existed. Yet an impressive percentage of these vessels remains. In one inventory of photographed pots, the vast archive assembled by Justin Kerr, close to a quarter or more of all known ceramics with named owners belonged to *ch'ok*. That proportion suggests not just a random pattern but one with decisive ties to princes or high-born males on the cusp of manhood. In some sense, the mythic beings and historical personages adorning these pots might have served a pedagogical purpose, a way to instruct and remind the viewer about supernatural and dynastic precedents.

Such ownership hints at a primary function of many ceramics, to observe a key moment when a young male comes of age or enters into adult company. A pot contained more than just sipping liquid, no matter how exquisite the drink. Among the Classic Maya, it implied protocols of royal courts, an ancient version of deciding which dining implement to use at an elaborately set Victorian table. Knowing how or when to eat and drink, how to interact with others in that convivial (but always political and judgmental) setting, required skill. The unschooled might blunder into many likely gaffes, and a social contest likely ensued to determine who showed the greatest elegance or genteel grace.

Viewing the ceramics for chocolate, *atole*, or tamales at LACMA produces another enduring impression, that they were used over time. Not a few display signs of wear, often a slight abrasion on their rims or a scuffing on their bases. But this may miss a vital feature, that their commissioning took place at a particular time, a crucial moment: Production for princes occurred episodically, of not just one vessel but many, and for specific occasions, not simply as the standard equipment of everyday life. This aspect of Maya ceramics may account for the existence of multiple pots relating to certain princes and kings. For example, a ruler of Naranjo, Guatemala, who came to the throne at a very young age in the sixth century CE, boasts a large set of bowls attributable to his reign, in fact, many to his early years. They exhibit wide dispersion too: One chocolate pot in this series was excavated from a tomb on the outskirts of the enemy kingdom of Tikal. Were these the by-product of a lavish ceremony, the result of a concentrated act of ceramic production? Some such ceramics went as sets into tombs. Excavations in a crypt at Holmul, Guatemala, exposed bowl after bowl, dish after dish, possibly made by the same hands and surely adorned by the same painter (fig. 3).[13]

This is where the centuries drop away, and those beholding the ceramics at LACMA can attend the ghostly celebrations at courts long ago. They have entered into the subtle, social lives of Maya pots.

13 Diana Méndez Lee and Nina Neivens, "Análisis cerámico del Proyecto Arqueológico Holmul, temporadas 2012–2016," in *Investigaciones arqueológicas y conservación de arquitectura monumental en la región de Holmul, temporada 2017*, ed. Francisco Estrada-Belli (New Orleans: Middle American Research Institute, Tulane University, 2018).

Fig. 2
Example of *chak ch'ok* glyphic phrase, from *Cylinder Vessel with Water-Lily Serpent*, cat. 23

Fig. 3
Four bowls by identical hand, early Late Classic Maya, Burial HOL.L.20.21, Building A, Group II, Holmul, Guatemala

Checklist of the Study

Cat. 1
Cylinder Vessel with Way Entities
Northern Peten, Guatemala, or southern Campeche, Mexico, 680–750 CE
Engobe-painted ceramic
Height: 5 1/8 in. (13 cm); diameter: 5 3/8 in. (13.7 cm)
Gift of the 2006 Collectors Committee
M.2006.41
K531

Cat. 2
Cylinder Vessel with Dynastic List of the Kaanul (Snake) Kingdom
Northern Peten, Guatemala, or southern Campeche, Mexico, 680–750 CE
Engobe-painted ceramic
Height: 6 1/2 in. (16.5 cm); diameter: 5 5/8 in. (14.3 cm)
Purchased with funds provided by Camilla Chandler Frost
M.2010.115.1
K6751

Cat. 3
Codex-Style Cylinder Vessel with Avian Maize God
Northern Peten, Guatemala, or southern Campeche, Mexico, 680–750 CE
Engobe-painted ceramic
Height: 5 1/2 in. (13.9 cm); diameter: 3 7/10 in. (9.4 cm)
Purchased with funds provided by Camilla Chandler Frost
M.2010.115.462
K1387

Cat. 4
Codex-Style Bowl with Avian Maize God
Northern Peten, Guatemala, or southern Campeche, Mexico, 680–750 CE
Engobe-painted ceramic
Height: 2 1/2 in. (6.4 cm); diameter: 6 3/4 in. (17.3 cm)
Purchased with funds provided by Camilla Chandler Frost
M.2010.115.461
K1388

Cat. 5
Cylinder Vessel with Supernatural Birth Scene
Northern Peten, Guatemala, or southern Campeche, Mexico, 680–750 CE
Engobe-painted ceramic
Height: 6 1/2 in. (16.5 cm); diameter: 5 5/8 in. (14.3 cm)
Purchased with funds provided by Camilla Chandler Frost
M.2010.115.3
K5164

Cat. 6
Cylinder Vessel with Palace Scene
Dos Pilas or vicinity, Peten, Guatemala, 740–800 CE
Engobe-painted ceramic with postfire paint
Height: 7 1/8 in. (18.1 cm); diameter: 5 1/8 in. (13 cm)
Purchased with funds provided by Camilla Chandler Frost
M.2010.115.12
K1599

Cat. 7
Cylinder Vase with Moon Goddess and Celestial Beings
Mexico or Guatemala, 600–900 CE
Engobe-painted ceramic
Height: 10 in. (25.4 cm); diameter: 3 4/5 in. (9.7 cm)
Purchased with funds provided by Camilla Chandler Frost
M.2010.115.628
K5166

Cat. 8
Cylinder Vessel with Scene Related to Warfare and Offering
Naranjo or vicinity, Peten, Guatemala, 550–620 CE
Engobe-painted ceramic
Height: 8 1/4 in. (21 cm); diameter: 7 3/8 in. (18.6 cm)
Purchased with funds provided by Camilla Chandler Frost
M.2010.115.871
K7716

Cat. 9
Cylinder Vessel with Scene of Supernatural Marriage Rituals
Peten, Guatemala, 600–900 CE
Engobe-painted ceramic
Height: 9 3/4 in. (24.9 cm); diameter: 4 1/2 in. (11.4 cm)
Purchased with funds provided by Camilla Chandler Frost
M.2010.115.585
K5847

Cat. 10
Squared Vessel (Vase of the Eleven Gods)
Naranjo or vicinity, Peten, Guatemala, c. 755–780 CE
Engobe-painted ceramic with postfire stucco
Dimensions: 9 5/8 × 6 1/2 × 6 3/8 in. (24.5 × 16.5 × 16.2 cm)
Anonymous gift
M.2010.115.14
K7750

Cat. 11
Squared Vase with Supernatural Birth Scenes
Northern Peten, Guatemala, or southern Campeche, Mexico, 650–750 CE
Engobe-painted ceramic
Dimensions: 10 × 4¹/₄ × 4¹/₄ in. (25.4 × 10.8 × 10.8 cm)
Purchased with funds provided by Camilla Chandler Frost
M.2010.115.452
K5113

Cat. 12
Tripod Cylinder Vessel in Teotihuacan Style
Peten, Guatemala, late 4th–early 5th century
Slipped ceramic with stucco and postfire pigment
Height: 9 in. (22.9 cm); diameter: 9¹/₂ in. (24.1 cm)
Anonymous gift
M.2010.115.1066a–b
K7529

Cat. 13
Tripod Cylinder Vessel in Teotihuacan Style
Peten, Guatemala, late 4th–early 5th century
Slipped ceramic with stucco and postfire pigment
Height: 9 in. (22.9 cm); diameter: 9 in. (22.9 cm)
Anonymous gift
M.2010.115.1068a–b
K7530

Cat. 14
Tripod Cylinder Vessel in Teotihuacan Style
Peten, Guatemala, late 4th–early 5th century
Slipped ceramic with stucco and postfire pigment
Height: 8¹/₂ in. (21.6 cm); diameter: 8 in. (20.3 cm)
Anonymous gift
M.2010.115.1067a–b
K7528

Cat. 15
Lidded Tripod Cylinder Vessel with Head of Cacao Deity
Naranjo or vicinity, Peten, Guatemala, early 5th century
Slipped ceramic with stucco and postfire pigment
Height: 11¹/₂ in. (29.2 cm); diameter: 5¹/₄ in. (13.3 cm)
Purchased with funds provided by Camilla Chandler Frost
M.2010.115.22a–b
K8042

Cat. 16
Tripod Vessel with Supernatural Musicians
Guatemala or Mexico, 500–700 CE
Slipped ceramic with stucco and postfire pigment, including Maya blue
Height: 6 5/8 in. (16.8 cm); diameter: 6 in. (15.2 cm)
Purchased with funds provided by Camilla Chandler Frost
M.2010.115.21
K1534

Cat. 17
Tripod Vessel with Supernatural Palace Scene and Cacao Tree
Motul de San José or vicinity, Peten, Guatemala, 750–850 CE
Engobe-painted ceramic
Height: 12 in. (30.5 cm); diameter: 6 1/4 in. (16 cm)
Purchased with funds provided by Camilla Chandler Frost
M.2010.115.430
K631

Cat. 18
Cylinder Vessel with Pedestal Base ("The Perfect Pot")
Peten, Guatemala, or Campeche, Mexico, possibly Los Alacranes, 650–850 CE
Engobe-painted ceramic with postfire stucco and Maya blue
Height: 6 5/8 in. (16.8 cm); diameter: 5 in. (12.7 cm)
Purchased with funds provided by Camilla Chandler Frost
M.2010.115.13
K7524

Cat. 19
Globular Bowl with Cartouches
Naranjo or vicinity, Peten, Guatemala, 550–620 CE
Engobe-painted ceramic
Height: 7 1/4 in. (18.3 cm); diameter: 7 1/2 in. (19.1 cm)
Purchased with funds provided by Camilla Chandler Frost
M.2010.115.756
K6813

Cat. 20
Lidded Vessel with Images of an Open Hand
Guatemala or Mexico, 580–700 CE
Engobe-painted ceramic
Height: 8 7/8 in. (22.4 cm); diameter: 6 3/4 in. (17.3 cm)
Purchased with funds provided by Camilla Chandler Frost
M.2010.115.981a–b
K6964

Cat. 21
Cylinder Vessel with Maize God Dancers and Dwarf
Xultun or vicinity, Peten, Guatemala, 650–850 CE
Engobe-painted ceramic
Height: 6 3/8 in. (16.2 cm); diameter: 3 in. (7.6 cm)
Purchased with funds provided by Camilla Chandler Frost
M.2010.115.616
K5976

Cat. 22
Cylinder Vessel with Water-Lily Serpent
Peten, Guatemala, possibly Tikal or Peten Lakes region, 700–800 CE
Engobe-painted ceramic
Height: 8 in. (20.3 cm); diameter: 4 1/4 in. (10.9 cm)
Purchased with funds provided by Camilla Chandler Frost
M.2010.115.572
K1941

Cat. 23
Cylinder Vessel with Water-Lily Serpent
Río Azul or Xultun or vicinity, northern Peten, Guatemala, 650–850 CE
Engobe-painted ceramic
Height: 9 3/4 in. (24.9 cm); diameter: 4 in. (10.2 cm)
Purchased with funds provided by Camilla Chandler Frost
M.2010.115.844
K7459

Cat. 24
Cylinder Vessel with Maize God Dancers and Dwarfs
Naranjo or vicinity, Peten, Guatemala, 650–850 CE
Engobe-painted ceramic with postfire pigment
Height: 9 3/8 in. (23.8 cm); diameter: 3 7/8 in. 9.7 cm)
Purchased with funds provided by Camilla Chandler Frost
M.2010.115.495
K3400

Cat. 25
Cylinder Vessel with Hunal Motif
Peten, Guatemala, possibly Xultun or vicinity, 8th century
Engobe-painted ceramic
Height: 6 3/4 in. (17.1 cm); diameter: 3 1/8 in. (7.9 cm)
Purchased with funds provided by Camilla Chandler Frost
M.2010.115.790
K7055

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